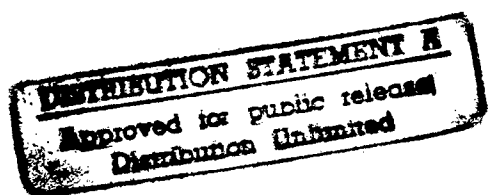




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# ***JPRS Report***



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# **Science & Technology**

***USSR: Electronics &  
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UDC 681.3

PERSONAL COMPUTER SYSTEM FOR EXPERIMENTAL AND SCIENTIFIC RESEARCH IN DIGITAL  
SIGNAL PROCESSING

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian  
Vol 29, No 9, Sep 86 (manuscript received 19 Jul 85) pp 32-37

[Article by G.A. Kukharev, V.P. Kniva and A.B. Chitavichyus, Kaunas Polytechnical  
Institute, recommended by Department of Radio Instruments]

[Abstract] The Elektronika 60 microcomputer is used with a PLX 45D floppy disk store, an Endim 620.20 plotter, a color graphics display based on the Shilyalis 410D TV as well as a DZM-180 alphanumeric printer and an analog signal input-output peripheral in order to create a digital signal processing system capable of: 1) studying methods and algorithms for processing signals of different physical natures; 2) processing analog and digital signals, storing them in both analog and digital form as well as monitoring them visually and aurally while performing A/D and D/A conversions; 3) providing an interactive capability for nonprogrammer users by using a menu format; 4) providing users with service and system capabilities for simulation and analysis of large data volumes. Block diagrams show the computer system in general and the analog signal input circuitry in particular. The latter employs input low-pass filters and an analog switcher and F7077/1 A/D converter with a conversion time of 8 microseconds per readout having a signal digitization frequency tuning range from 1 Hz to 125 kHz. The problem-oriented software is based on three main components: the RAFOS operating system, a package of programs for fast digital orthogonal transforms (the BODIS package of applied programs) and a library of user programs. The speed of the signal analysis system can be more doubled by replacing the Elektronika 60 with the Elektronika MS 1211 microcomputer. Figures 5; references: 8 Russian.

8225/13046  
CSO: 1860/47

## METHOD OF ESTIMATING SIGNAL PARAMETERS USING KALMAN FILTER UNDER CONDITIONS OF INTERFERENCE INDETERMINACY

Leningrad IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 29, No 9, Sep 86 (manuscript received 24 Oct 85) pp 3-7

[Article by V.V. Chikovani, Kiev]

[Abstract] Optimal filtration of noise from an additive mixture of signal and noise is achieved using a technique that generates a linear estimate of the measurement function parameters by means of a Kalman filter. It is assumed that the spectral density of the measurement noise can be approximated by a rational fractional function, the parameters of which are a priori unknowns, while the measurement function in the general case is a nonlinear function of the parameters being determined. A Kalman filter is synthesized for the generation of an optimal (in the sense of a minimal estimate error dispersion) estimate of the parameter vector found from the measurement data. The final determination of the estimates of the vector of the component parameters from the estimates of the state vector is found by solving algebraic equations. The proposed method is applied to the case of a sinusoidal signal with an added steady-state Gaussian random noise component with a rational fractional spectral density; analytical expressions are derived for the signal amplitude and phase as well as the estimate error dispersion. No numerical examples or applications are cited. References 3: 1 Russian, 2 Western (in Russian translation).

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CSO: 1860/47

## OPTIMIZATION OF DIRECT METHOD FOR CALCULATING CIRCULAR CONVOLUTIONS OF DISCRETE SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 10, Oct 86 (manuscript received 3 May 84) pp 1,983-1,988

[Article by M.I. Mazurkov]

[Abstract] The arithmetical complexity is investigated of an algorithm for direct calculation of a circular convolution which is the result of multiplication of an arbitrary vector  $X$  of order  $N$  for a matrix, composed of elements of  $q$  reference signals, with the condition  $2 \leq q < N$ . A number of parameters of computing procedure are introduced and with allowance made for the  $q$  structure of the reference matrix their optimization is conducted with respect to the criteria of a minimum algebraic summation operation. Optimization of the internal procedure, and compatible optimization of exterior and interior computing procedures are considered in some detail. References: 2 Russian.

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CSO: 1860/65



COMPENSATION OF PHASE DISTORTIONS IN DISCRETE APERTURES DURING MOVEMENT OF AN OBSERVED OBJECT

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 10, Oct 86 (manuscript received 16 Apr 84) pp 2,061-2,070

[Article by Yu.V. Zhulina]

[Abstract] Three published articles are cited concerning digital modeling of images which solve the problem of compensating phase distortions constant in time. In a fourth article this same problem is considered in the case of distortions variable in time. However, the compensation procedure described in this fourth article proved to be susceptible to a nonunique advance of phase, obtained during measurement of the phases of the field at the receiving aperture. In so doing linear combinations of phase distortions, coded in the phases of signals of various positions, and consequently the phase distortions themselves, can also be estimated in more than one way. In the present article a compensation algorithm is synthesized with preliminary mutual agreement of the measured phases of the signals in various positions, definitely providing a correct restoration of the phase distortion function. Figures 5; references: 4 Russian.

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UDC 621.792.053.004.14.778.5+678.049.16.004.4:778.5

INTENSIFICATION OF MOTION PICTURE EQUIPMENT PRODUCTION BY MEANS OF GLUE JOINTS

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 11, Nov 86 pp 3-7

[Article by V.L. Bronnikov, Leningrad Institute of Motion Picture Engineers]

[Abstract] Use of glue joints is an important reserve for intensification of production and improvement of the construction of motion picture equipment, by making it possible for the motion picture industry to use the most progressive technological processes based on a radical improvement in the use of new materials. The wide assortment of glues for various purposes produced in the USSR for the needs of the national economy makes it possible to use this reserve immediately. A method is proposed for checking glue joints for various types of construction. The advantages are shown of glue joints over traditional ones (welded, bolted, key-type). References: 5 Russian.

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UDC 778.53:534.322.3]001.24

CALCULATION OF ACOUSTIC NOISE LEVELS PRODUCED BY MOTION PICTURE FILM DURING OPERATION OF FILM CAMERAS AND PROJECTORS

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 11, Nov 86 pp 7-11

[Article by E.L. Vinogradova, G.I. Golubeva and M.Yu. Liberman, All-Union Scientific Research Institute of Motion Picture Film]

[Abstract] An engineering method is developed for calculation of the noise levels produced by film loops in film cameras and projectors. It is shown that the noise is produced by bending-type vibrations of a film loop at its inherent resonance frequencies. The results of calculating the noise level by this method satisfactorily agree with experimental returns. The method of calculation can be used at the stage of determining the minimum permissible acoustic insulating ability of the walls of the body of the filming equipment. Figures 2; references 10: 9 Russian, 1 Western.

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CSO: 1860/59

PROSPECTIVE AUDIO CONTROL CONSOLE FOR RADIO AND TELEVISION CENTERS

Moscow TEKHNICA KINO I TELEVIDENIYA in Russian No 11, Nov 86 pp 12-18

[Article by A.V. Grabchak, A.G. Kiriyenko, A.B. Kirshe and Yu.A. Storozhuk, Vinnitskiy Polytechnical Institute]

[Abstract] Trends in the development of audio control consoles are considered, as applied to digital virtual control, display information presentation, and digital sound signal processing. Details on audio control consoles with virtual control and devices for digital processing of signals are listed in tables. The control principle, functional composition and architecture of an advanced audio console for radio and television centers are proposed. Figures show the structure of the audio facility and the architecture of the computational means. Figures 2; references 12: 8 Russian, 4 Western.

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UDC 621.397.61:621.397.132]072.6.078

ALGORITHMS FOR AUTOMATIC ALIGNMENT OF COLOR TELEVISION CAMERAS

Moscow TEKHNICA KINO I TELEVIDENIYA in Russian No 11, Nov 86 pp 18-27

[Article by B.N. Bychkov and B.S. Timoreyev, Leningrad Institute of Aviation Instrument Building]

[Abstract] The criteria with respect to a generalized quality index chosen for inclusion in an algorithm concerned with automatic alignment of a color TV camera are precision, speed of response, and complexity of apparatus realization. Special-purpose functions are investigated. Simulation of methods of search for the extreme values of the quality function is achieved, as the result of which an optimum adjustment-algorithm is synthesized. Figures 7; references 11: 10 Russian, 1 Western (in Russian translation).

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FOURFOLD REDUCTION OF BIT STREAM DURING GROUP CODING OF TELEVISION PICTURES

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 11, Nov 86 pp 27-32

[Article by S.A. Kulikov, S.V. Sardyko and A.S. Shmygol, All-Union Scientific Research Television Institute]

[Abstract] Block truncated coding of television pictures with reduction of the absolute moments of sampling is a special case of an algorithm of adaptive group coding with approximation of coded fragments at two levels. It is experimentally determined that for development of line-by-line scanning of television pictures, adaptive group coding of fragments 2 x 2 with two levels does not lead to deterioration of the quality of the pictures being resolved. An adaptive strategy for quantization of coefficients is proposed, use of which made it possible to reduce the volume of the output of the bit stream by fourfold without loss of picture quality. Figures 2; references 14: 5 Russian, 9 Western (1 in Russian translation).

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DEVICE INTERFACING THE K2-35 TELEVISION SIGNAL PARAMETERS METER WITH AN MPUL6-3 SMALL-SIZE DIGITAL PRINTER

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 11, Nov 86 pp 60-61

[Article by V.K. Pozdnyakov, Main Control Center for Inter-City Communications]

[Abstract] The purpose and functions of a proposed device for interfacing the K2-35 television signal parameters meter with an MPUL6-3 small-sized digital printer are described. In 1986 a model specimen of the device successfully underwent test exploitation in equipment control and switching of television programs at the Main Control Center for Inter-City Communications of the USSR Ministry of Communications. It can be recommended for introduction into the system of the State Committee for Television and Radio Broadcasting. A block diagram of the interfacing device is presented. Figures 1.

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## OUTLOOK FOR IMPROVING MATERIAL AND TECHNICAL BASE FOR PRODUCTION OF TELEVISION PROGRAMS

Moscow ELEKTROSVYAZ in Russian No 10, Oct 86 pp 2-5

[Article by G.Z. Yushkyavichyus]

[Abstract] Television broadcasting in the USSR began in 1939 and has always been a concern of the Communist Party as well as of the Soviet Government. It now reaches 90 percent of the population and outranks all other mass communication media. Projections for the 1986-90 period and beyond indicate further progress paralleling that in Western countries. Developments anticipated include improvements in programming with the necessary material and technical means. Microelectronic and digital techniques will be utilized in design and construction of new mobile television stations with better cameras as well as of new television receiver sets. The high-definition system with 1,000-1,300 lines instead of the present standard 625 lines will be introduced, new materials for image and sound recording will be developed. Programming will be extended on both informative and artistic levels. National, regional, and international coverage will be facilitated by multi-channel satellite systems operating in the 12 GHz frequency band. These systems together with cable television systems will make that coverage accessible to the entire population on a multiprogram basis. Concerted effort of scientists and engineers, producers and editors, as well as involvement of concerned ministries and enterprises will be required for attainment of these goals.

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## DIRECTIONS OF TELEVISION BROADCASTING NETWORK DEVELOPMENT IN TWELFTH FIVE-YEAR-PLAN PERIOD

Moscow ELEKTROSVYAZ in Russian No 10, Oct 86 pp 6-8

[Article by A.M. Varbanskiy]

[Abstract] Developments in the television broadcasting system in the USSR scheduled for the 12th Five-Year-Plan period and based on use of satellite communication systems (Moskva, Ekran) include organizing five-time-zones distribution of two programs from the Central station, reception of two programs (one program nationwide from the Central station and either another program from the Central station with local content in Russian SFSR or second program republic-wide in all other republics), boosting the power of existing television transmitters and adding the new ATRS-50 transmitter to supplement the existing Uragan and Len for the metric-wave band, installation of diplexer

bridges (manufactured in Czechoslovakia and Bulgaria) on receiver antennas, manufacture of new radio relays, simulcasting, improving the characteristics of transmission channels by replacement of obsolescing equipment, particularly reducing losses and image distortions, upgrading the skills of operating personnel and the performance of unattended relay stations, and upgrading the quality of manufactured television receiver sets and antennas. Tables 5.

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#### STATE OF ART AND MAIN TRENDS IN TELEVISION TRANSMITTER ENGINEERING DEVELOPMENT

Moscow ELEKTROSVYAZ in Russian No 10, Oct 86 (manuscript received 16 Jun 85)  
pp 9-12

[Article by A.I. Lebedev-Karmanov, L.V. Kalinin and M.M. Kozlovskiy]

[Abstract] Television broadcasting transmitters for ground stations operating in metric and decimetric wave bands are now manufactured in the USSR and in other industrial countries with video power ratings up to 80 kW, except few foreign-made compound transmitters with 110 kW or 220 kW peak power. Coaxial beam tetrodes are generally used in the output stage of the video channel for all transmitters, more efficient though less reliable multicavity klystrons being considered for decimetric-wave transmitters. There is a demand for still further increasing the mean efficiency of klystron amplifiers of modulated oscillations. Among the main problems in improvement of metric-wave transmitters are boosting the power of transistor stages and optimization of the standby capacity. Most transmitters have highly stable frequency synthesizers and appropriate precorrection stages. The latest trend in modulation technique is low modulation power and low intermediate frequency. This applies to both image channel and sound track. Innovations include stereophonic sound tracking, vapotron evaporation cooling of power transmitters manufactured abroad, and air cooling of vacuum devices in Soviet-made transmitters. A changeover to concurrent amplification of image and sound signals is imminent, additive amplification by the beat method having been adopted abroad and an original method of quadrature-pulse modulation having been proposed in the USSR. Computers are now used in transmitter stations for data processing, data analysis, control, fault identification, automation of measurement for continuous or periodic inspection, and documentation. Television transmitters are also being adapted to operation with satellite hookup and cable systems. References 19: 4 Russian, 15 Western.

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## FREQUENCY SYNTHESIZERS FOR MODERN TV RADIO STATIONS: DEVELOPMENT TRENDS

Moscow ELEKTROSVYAZ in Russian No 10, Oct 86 (manuscript received 25 Nov 85)  
pp 12-18

[Article by A.A. Artamonov, V.G. Ivanov and I.N. Poryvayev]

[Abstract] Frequency synthesizers for metric-wave and decimetric-wave TV radio transmitters are described, such synthesizers having been replacing quartz-wave exciters since the 1970's. They consist of three stages: intermediate-frequency stage for the image channel with frequency-modulation stage for the sound track, heterodyne-frequency stage for ATRS-5/1 and Don metric-wave transmitters or heterodyne-frequency stage for Ilmen decimetric-wave transmitters. Their main components are voltage-controlled oscillators, reference-frequency selectors, variable-divisor frequency dividers, and automatic-phase-control loops. A special exciter with frequency synthesization has been developed for Len, Uragan, Yakor, and Zona transmitters. Further design improvements are intended to result in high-speed frequency division with a divider range depending on the required shift of image carrier frequency and high interference immunity of the heterodyne-frequency signal. Technological trends helping to achieve this are circuit integration, printed-circuit assembly. Another trend is increased standardization encompassing metric-wave and decimetric-wave frequency synthesizers. Eliminating the shift of the intermediate frequency simplifies the overall synthesizer structure and makes it feasible to operate the automatic phase control in that stage with a 1 MHz reference signal. Figures 4; references: 4 Russian.

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## NEW DEVELOPMENTS IN STANDARDIZATION OF TV RADIO TRANSMITTERS

Moscow ELEKTROSVYAZ in Russian No 10, Oct 86 (manuscript received 12 Nov 85)  
pp 18-20

[Article by V.I. Shurskiy]

[Abstract] International exchange of television programs has made it necessary to standardize all components of the transmission channel. Accordingly, the CEMA Standard 3704-82 for TV radio transmitters had been developed and written to match the corresponding USSR GOST 20532-75. The technical requirements section of both standards was recently supplemented to include: 1) ability to operate continuously for 24 h, in black-field and no-signal modes for 2 h each with at least 2 h intermission, 2) identification of material content and power capacity of each transmitter type, 3) method of determining the actual mean time between failures and definition of failure, 4) determination of

length of operating time at nominal performance level, depending on the power gradation, 5) organization of measurements, specification of instruments and procedures, designation of test areas, and safety assurance for personnel. Several performance requirements have been changed to more stringent ones: background noise level from -42 dB (0.8%) to -46 dB (0.5%), nonlinearity at 1.2 MHz from 15% to 12%, frequency deviation in image channel from  $\pm 150$  Hz to  $\pm 100$  Hz within 1 month after 6 months in service, parasitic amplitude modulation from -48 dB to -50 dB, mean time between failures from 750/1,000 h to 1,000/2,000 h without and with standby, respectively, and availability factor from 99.5% to 99.8%. A new parameter has been added for transmitters with concurrent amplification of image and sound signals, namely, allowable intermodulation product at  $f_1+f_2-f_3$  and  $2f_3-f_2$  combination frequencies ( $f_1, f_2, f_3$  - frequencies of -7 dB image carrier, -10 dB sound carrier, -17 dB color subcarrier, respectively). Standardization of filters needed for measurement of background and fluctuation noise in the image channel (universal weighting filter with 245 ns time constant, low-pass with 1 kHz cutoff, low-pass with 6 MHz cutoff, high-pass with 10 kHz cutoff, 4.43 MHz band-pass) is now underway, pertaining to both design in terms of circuit elements and performance in terms of nominal amplitude-frequency characteristics, Figures 6; references: 2 Russian.

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#### COMPREHENSIVE MODERNIZATION OF YAKOR TV RADIO STATION

Moscow ELEKTROSVYAZ in Russian No 10, Oct 86 (manuscript received 5 Dec 85)  
pp 21-25

[Article by E.M. Fridman and I.V. Shelepen]

[Abstract] Comprehensive modernization of the Yakor TV radio station has been proceeding in steps, on the technically and economically soundest basis, this station being about 20 years old and installed in over 250 broadcasting centers. In the first step the terminal oscillator stages, with 2xGU-40B tubes, were in all centers reconnected into the common-grid configuration. In the second step these terminal oscillator stages were in 100 band-I centers reconnected with two grids galvanically grounded. In the third step one-line transmitter subassemblies were installed in 60 centers, with 2xGU-40B tubes replaced by more reliable and stable 1xGU-35B tubes in the common-cathode configuration. Further modifications are required here, to minimize the detrimental effect of feedback on modulation and amplitude-frequency characteristics, nonlinearity and parasitic modulation being most expediently eliminated by operation with low modulation power. In the fourth step the radio-frequency image channel was transistorized, KT922, KT931, and KT971 transistors having been found to be adequate and most suitable. In the next step the sound track should also be transistorized. Figures 9; references: 7 Russian.

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## MODERNIZATION OF URAGAN TV RADIO STATION

Moscow ELEKTROSVYAZ in Russian No 10, Oct 86 (manuscript received 9 Jul 86)  
pp 26-27

[Article by A.Yu. Orlov and A.K. Ramanauskas]

[Abstract] The sound track of the Uragan TV radio station, consisting of an exciter with synchronizing oscillator and an amplifier followed by an output stage with a GU-35B tube, has been modernized on the basis of engineering and testing done at the laboratory of the LiSSR radio television center. The exciter now operates at the carrier frequency of the transmitter, with direct frequency modulation by means of a variable capacitor and frequency stabilization by automatic frequency and phase control with a Giatsint high-stability oscillator serving as reference. The exciter output stage operates with amplitude limitation. There is 100 percent standby with automatic switchover provided for the exciter components. The amplifier consists of two Class C power stages in push-pull configuration, with tubes replaced by KT922 and KT971 transistors. Figures 2.

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## HIGH-QUALITY EXCITER FOR F-M SIGNALS

Moscow ELEKTROSVYAZ in Russian No 10, Oct 86 (manuscript received 5 Dec 85)  
pp 27-31

[Article by E.M. Fridman, I.V. Shelepen and Ye.V. Erikson]

[Abstract] Exciters built with electron tubes and operating with pulse-phase modulation in the sound track and in the image channel of VHF F-M TV radio transmitters are becoming obsolete so that a new method of frequency modulation using more adequate and modern devices had to be developed. Accordingly, transistors with satisfactory nonlinearity characteristics were selected for the F-M oscillator stage and suitable varicaps were selected as control elements. The exciter built on this basis consists of a tank circuit, an emitter-follower stage with two transistors designed so as to ensure zero phase shift, and another emitter-follower stage with two transistors acting as buffer before the load. This exciter operates at the 6.5 MHz frequency, generating frequency-coherent signals for the image channel and the sound track. Figures 8; tables 1; references: 6 Russian.

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## PARAMETERS OF TRAVELING-WAVE TV SLOT ANTENNAS

Moscow ELEKTROSVYAZ in Russian No 10, Oct 86 (manuscript received 18 Nov 85)  
pp 31-35

[Article by A.F. Ivanov]

[Abstract] Traveling-wave slot antennas, generally narrow-band ones, have several characteristics making them very suitable for transmitters in decimetric-wave TV stations. Their advantages over other antennas are simple configuration, easy assembly and installation on fiberglass support tubes, small weight and size, and above all high reliability. Such an antenna consisting of a 75 ohm coaxial feeder is considered, with 4 rows of 5 rectangular slots cut in the outer shell and excited from the inner conductor through probes. The distance between adjacent slots in each row is equal to the center wavelength, slots in even rows are shifted from corresponding slots in adjacent odd rows by a quarter of that wavelength. The energy distribution among the slot radiators and the radiation pattern of such an antenna are calculated and the phase velocity in the feeder, assuming identical coupling of all radiators to the inner feeder conductor and equal amplitudes of the excitation voltage for all radiators. Measurements were made in experiments with such an antenna for the 33th TV channel. Figures 7; references: 1 Russian.

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## AUTOMATIC MONITORING SYSTEM FOR TV CHANNELS

Moscow ELEKTROSVYAZ in Russian No 10, Oct 86 (manuscript received 17 Apr 86)  
pp 35-39

[Article by Yu.M. Bolovintsev, M.A. Morgulis and Ye.L. Ryvkin]

[Abstract] An automatic monitoring system for TV channels is described which conforms to CCIR and OIRT recommendations. It consists essentially of a controller and up to 64 analyzer instruments connected to it sequentially over 8 completely accessible data transmission or standard telegraph channels operating at a rate of 50 baud. The system measures 27 channel parameters in appropriate units and it operates in 15 different modes ranging from data collection to data display. Three variants of the basic system are available, with different peripheral equipment and appropriate modifications each. The basic unit is now used for monitoring several channels of the USSR Central TV Broadcasting System and was used during the 12th International Youth and Student Festival. Figures 2; tables 1; references 9: 4 Russian, 2 Polish, 3 Western (1 in Russian translation).

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## PROCEDURES FOR CONVERSION OF AVAILABLE RTsTA-70 TELEVISION RELAYS TO UNATTENDED MODE OF OPERATION

Moscow ELEKTROSVYAZ in Russian No 10, Oct 86 (manuscript received 5 Feb 86)  
pp 43-45

[Article by V.V. Panayev]

[Abstract] Conversion of television relays to unattended mode of operation requires preparatory scientific research and engineering work, which includes gathering and processing statistical data on relay failures, identification of major causes of relay failure, testing for verification, consultation with experts, design for higher reliability and remote controllability, review of management and maintenance problems, and experimental operation of prototypes. These procedures were followed prior to conversion of RTsTA-70 low-power relays available in the Kuybyshev oblast. Similar modernization work was also done in Chelyabinsk and Kirov oblasts. Most efficient and fastest conversion is carried out in two steps, installation of KURA-R automation equipment (available since 1985) to be followed by installation of transistor amplifiers (to be available by 1987) in the image channel and in the sound track. Figures 1; references: 3 Russian.

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## MODERNIZATION OF RTsTA TELEVISION RELAY

Moscow ELEKTROSVYAZ in Russian No 10, Oct 86 (manuscript received 2 Feb 86)  
pp 46-48

[Article by V.K. Yemelyanov and V.G. Obukhovich]

[Abstract] Modernization of RTsTA-70 television relays is considered, to make them suitable for unattended mode of operation. The high-frequency channel must be made more reliable and immune to destabilizing effects, also more easily aligned and maintained. This channel contains a UIP-0.159 image pre-amplifier stage and a UIO-0.163 image output amplifier stage with a GU-34B-1 power tube feeding the antenna. An output power of 200 W and a very low level of intermodulation distortion make it feasible to replace the image pre-amplifier with a sound-and-image preamplifier UZIP-1/2 for TV bands I, II or UZIP-3 for TV band III. Modifications include also protecting the high-voltage (+1,000 V) rectifier in the plate supply for the power tube with a fuse against short circuit and thermostatically enclosing both image and sound receivers. Experimental operation of a thus modified existing RTsTA-70 television relay has been successful. Figures 4; tables 1.

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## NEW AUTOMATION EQUIPMENT FOR RTsTA-70 TELEVISION RELAYS

Moscow ELEKTROSVYAZ in Russian No 10, Oct 86 (manuscript received 5 Feb 86)  
pp 48-49

[Article by G.V. Mazharov and D.V. Khokhlov]

[Abstract] New automatic protective equipment KURA for RTsTA-70 television relays has been developed and built, combining automatic controls with monitoring and indicating devices in a single module. This KURA module accordingly replaces the existing BA-0.000 and both BKI-5.005 modules, with only very few reconnections in the RTsTA-70 circuitry. The module contains an analyzer of input and output signals and two control loops with a common automation unit, consisting of an electronic time relay, a control device, and a standby switching device; and can receive fire and impairment signals which automatically switch off the device. The equipment is totally enclosed in a box with a removable cover. Figures 2.

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## SYNTHESIZER OF HETERODYNE FREQUENCIES FOR TELEVISION RELAYS

Moscow ELEKTROSVYAZ in Russian No 10, Oct 86 (manuscript received 18 Oct 85)  
pp 51-53

[Article by N.A. Simonov and S.V. Naganyuk]

[Abstract] A frequency synthesizer has been developed and built for generating a grid of heterodyne frequencies without shift of the carrier frequency in metric-wave television relays. It consists of a 5 MHz quartz reference oscillator, a phase detector with low-pass filter, a voltage-controlled output oscillator with wideband transistor amplifier, and a variable-divisor frequency divider feeding back to the phase detector. The synthesizer requires two power supplies, +5 V (0.5 A) and  $\pm 12$  V ( $\begin{smallmatrix} 0.2 \text{ A} \\ 0.01 \text{ A} \end{smallmatrix}$ ). Its output voltage across a 50 ohm load is 1 V, with second-harmonic ripple not exceeding -40 dB and phase noise not exceeding -55 dB. It is tunable in 250 kHz steps, over a range depending on the relevant circuit elements in the output oscillator. The upper frequency limit for the variable-divisor frequency divider is 294 MHz. Figures 5; references 2: 1 Russian, 1 Western (in Russian translation).

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## TRANSMISSION OF TWO TELEVISION PROGRAMS IN ANALOG OR DIGITAL FORM OVER ONE SATELLITE CHANNEL

Moscow ELEKTROSVYAZ in Russian No 10, Oct 86 (manuscript received 8 May 86)  
pp 54-60

[Article by V.L. Bykov, V.I. Dyachkov, E.I. Kumysh, V.S. Rabinovich and  
N.G. Kharatishvili]

[Abstract] Transmission of two television programs over one satellite channel is considered, in analog or digital form. Frequency division and time division of channels, or a combination of both techniques, are available for transmission of programs in analog form with frequency modulation. For transmission of programs in digital form with phase keying are available time division of channels and various other recently developed systems. Such systems are the Japanese NETEC-22H transmitting NTSC signals at 20-30 Mbit/s and the Intelsat transmitting NTSC, PAL, SECAM signals with reduced redundancy at an acceptable lower rate of 15 Mbit/s using a universal codec with adaptive interframe prediction. Another codec with intraframe adaptive differential pulse-code modulation has been developed by N.G. Kharatishvili for transmission of color television programs at a rate of 24 Mbit/s. The authors thank L.Ya. Kantor for stating the problem and for helpful suggestions. Figures 3; tables 1; references 19: 11 Russian, 8 Western.

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## ANALOG-DIGITAL METHOD OF TRANSMITTING STEREOPHONIC TV SOUND TRACK SIGNALS

Moscow ELEKTROSVYAZ in Russian No 10, Oct 86 (manuscript received 25 Nov 85)  
pp 60-62

[Article by A.A. Artamonov and Yu.G. Lyubimov]

[Abstract] Transmission of stereophonic sound track signals in the SECAM color television system by the analog-digital method is described, the sum signal being transmitted in analog form as a monophonic one and the difference signal being transmitted in digital form as a part of the total chrominance signal. The unmodulated chrominance-subcarrier signal rides on the line quenching pulse, occupying a 5  $\mu$ s segment just before the active line segment begins, this portion of the line quenching pulse being in PAL and NTSC systems allocated for receiver synchronization and correct resolution of quadrature components in the chrominance signal. The maximum attainable rate of transmission of such a stereophonic signal by this method, estimated on the basis of signal spectrum analysis and given system parameters, is 2.4 Mbit/s with single phase-difference modulation and 4.8 Mbit/s with double phase-difference

modulation. Experimental data indicate that digital transmission of the stereophonic difference signal is compatible with standard television receivers. Owing to pauses in the frame quenching pulse, caused by absence of the chrominance-subcarrier signal in some lines, a memory is needed for reception of digital signals with a capacity equal to information transmitted during the frame quenching pulse. The size of that memory can be decreased to information transmitted during one line only, if the frame quenching pulse is additionally cut into during the frame synchronizing signal and additionally flashed by the chrominance-subcarrier signal in lines not transmitting. Sufficient data are not available for a comparative evaluation of this method and polarity modulation in the stereophonic sound track, but the advantages of the new method are self-evident. Figures 4; references: 5 Russian.

2415/13046

CSO: 1860/67

UDC 621.396.67

UNEQUALLY-SPACED SPARSE ANTENNA ARRAYS WITH OPTIMAL CONFIGURATION OF RADIATING ELEMENTS BASED ON DIFFERENCE SETS

Kiev DOKLADY AKADEMII NAUK UKRAINSKOY SSR: SERIYA A: FIZIKO-MATEMATICHESKIYE I TEKHNICHESKIYE NAUKI in Russian No 9, Sep 86 (manuscript received 16 Jul 85) pp 45-48

[Article by L.Ye. Kopilovich and L.G. Sodin; presented by UkSSR Academy of Sciences Academician A.Ya. Usikov; Institute of Radiophysics and Electronics, UkSSR Academy of Sciences, Kharkov; Department of Radio Astronomy, Institute of Radiophysics and Electronics, UkSSR Academy of Sciences]

[Abstract] Sparse (thinned) antenna arrays of unequally-spaced elements can provide high resolution and gain while having low sidelobes and generally requiring less space than other designs. This paper for the first time determines a technique for optimizing the spacing of the radiating elements. The approach is based on so-called cyclic difference sets (known from combinatorial analysis) that reduce the array design for the lowest sidelobe level to the inspection of all the sets so as to find the one producing the optimal unequal spacing. This analysis employs two-dimensional cyclic difference sets defining the coordinates of the elements arranged at the nodes of a regular rectangular grid. Sample calculations are given for four different arrays with from 31 to 122 elements having sidelobes of from 10.8 dB to 13.4 dB (down from the main lobe). The method given here for constructing two-dimensional sparse arrays enables the design of systems extremely close to the optimal, but most importantly, the method has no competitors for large antennas. References 9: 3 Russian, 6 Western (2 in Russian translation).

8225/13046

CSO: 1860/53

## DIFFRACTION AND EXCITATION OF SURFACE WAVES PROPAGATING AT A PLASMA-METAL BOUNDARY

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 10, Oct 86 (manuscript received 1 Aug 83) pp 1,889-1,893

[Article by N.A. Azarenkov, G.I. Zaginaylov and A.N. Kondratenko]

[Abstract] In previous works by Azarenkov and Kondratenko it is shown that surface waves can propagate along a plasma-metal boundary. With respect to the dispersion characteristics and topography of the field, these waves substantially differ from known surface waves at a plasma-vacuum boundary. The present article considers some problems of diffraction and excitation of a surface wave propagating along a plasma-metal boundary by the method of paired integral equations. References: 3 Russian.

6415/13046  
CSO: 1860/65

## SIGNAL POWER AFFILIATED WITH RADIOACOUSTIC SOUNDING OF ATMOSPHERE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 10, Oct 86 (manuscript received 8 Apr 85) pp 1,903-1,908

[Article by A.I. Kon and V.I. Tatarskiy]

[Abstract] A problem is considered concerned with scattering of a continuous radio wave by a sound pulse propagating in the atmosphere. With the use of a Gaussian approximation for the distribution of fields at the exciters and apertures of the antennas, expressions are obtained for the power of the signal received. (This refines the formula cited earlier in a 1972 article by J.M. Marshall, A.M. Peterson, and A.A. Barnes.) These expressions are easy to generalize in the case of an arbitrary arrangement of antennas, e.g., in the bistatic arrangement most frequently used in experiments. The distinctive features are discussed of the operation of the antenna system in the problem of radioacoustic sounding of the atmosphere and the practical conclusions following from this. Similar questions do not arise in ordinary radar problems because there focusing of the reflected radiation at the receiving antenna does not take place. References 6: 4 Russian, 2 Western.

6415/13046  
CSO: 1860/65



## CONCERNING THE POSSIBILITY OF FORECASTING ATTENUATION OF MILLIMETER AND OPTICAL WAVES IN HORIZONTAL TRACKS THROUGH SNOWFALLS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 10, Oct 86 (manuscript received 6 Feb 85) pp 1,922-1,929

[Article by L.P. Trukhanova and V.N. Pozhidayev]

[Abstract] An analysis is presented of meteorological and radiophysical information concerned with the problem of forecasting the attenuation of millimeter and optical waves in snowfalls. It is shown that the following are necessary for creating an algorithm for an average-annual or season-annual forecast of the attenuation probability: 1) to measure the microstructure characteristics of snowfalls and to obtain statistically a valid attenuation coefficient with the intensity and type of snowfall; 2) to obtain data concerning the geometrical dimensions of the zone of a given type of snowfall; and 3) to obtain for various districts of the USSR the probability distribution of the intensity of various types of snowfall or the attenuation coefficient studied in snowfall, measured in the course of 2-3 years. Figures 5; references 41: 16 Russian, 25 Western.

6415/13046  
CSO: 1860/85

## ESTIMATION OF ANGULAR COORDINATES IN THE PRESENCE OF SPACE-CORRELATED INTERFERENCE IN ADAPTIVE RADAR STATIONS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 10, Oct 86 (manuscript received 24 Jun 83) pp 1,947-1,954

[Article by A.K. Zhuravlev]

[Abstract] Precise solution of the relation of the gain factor of adaptive angle-measuring channels, with the presence of space-correlated interference, are obtained, and their connection with estimates of orthogonal regression is determined. The causes for distortion of a direction-finding characteristic are investigated and methods for their correction are determined. The problem of adaptation of a difference channel with stabilizations of the zero and gain factor of a direction-finding characteristic is solved for a wide range of nonconventional and conventional methods for optimization of a detection (summary) channel. References 7: 5 Russian, 1 non-Russian, 1 Western (in Russian translation).

6415/13046  
CSO: 1860/65

## ON CALCULATION OF THE STATISTICAL CHARACTERISTICS OF BACK-SCATTERING SIGNALS IN RANDOM-IRREGULAR IONOSPHERIC WAVEGUIDE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 10, Oct 86 (manuscript received 1 Apr 85) pp 1,975-1,982

[Article by V.N. Lagutkin]

[Abstract] With the assistance of the reciprocity theorem, a method is presented for calculating the statistical characteristics of back-scattering signals in a random-irregular ionospheric waveguide. In the article the term "ionosphere waveguide" designates an earth-ionosphere waveguide, including in itself ionosphere waveguide channels. Although only an ionospheric waveguide is considered, the method developed for a description of the statistical characteristics of back-scattering signals can also be used for other refraction waveguides: tropospheric and submarine (for acoustic waves in the ocean). Figures 3; references: 6 Russian.

6415/13046  
CSO: 1860/65

## FLUCTUATIONS OF THE RADIO EMISSION OF A CLOUDLESS ATMOSPHERE AT CENTIMETER WAVELENGTHS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 10, Oct 86 (manuscript received 26 Mar 85) pp 1,999-2,002

[Article by A.A. Stotskiy, A.V. Berlin, M.N. Kaydanovskiy and V.B. Khaykin]

[Abstract] The intensity of fluctuations of the brightness temperature of a cloudless atmosphere was measured over 2-1,000 second intervals of time on the RATAN-600 radio telescope at a wavelength of 7.6 cm. An estimate of the structural coefficient of  $0.86 \cdot 10^{-4} \text{ K} \cdot \text{s}^{-5/6}$  was obtained for the structural function of atmosphere fluctuations described by the law "of power 5/3." Measurements were conducted by means of a radiometer, the functional response of which is characterized by a structural function "of power 2/5" with an average value of the structural coefficient of  $4.6 \cdot 10^{-3} \text{ K} \cdot \text{s}^{-1/5}$ . The estimate obtained for the intensity of fluctuations of the radio emission of a cloudless atmosphere characterizes the nonhomogeneity of its dry component (oxygen) and can be used in the long-wave part of the centimeter band. With waves less than 4 cm long a substantial fluctuation begins, caused by emission of water vapor and connected with fluctuations of its distribution in the atmosphere. For an estimate of the intensity of these fluctuations measurements at shorter waves is necessary. The authors thank K.A. Aliakberov for assistance during the observations. Figures 1; references 10: 9 Russian, 1 Western.

6415/13046  
CSO: 1860/65

UDC 621.396.969.14'03

ESTIMATION OF ERROR CAUSED BY ATMOSPHERIC TURBULENCE WHEN MEASURING THE  
RADIAL COMPONENT OF AN OBJECT'S SPEED BY A HETERODYNE RADAR

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 10, Oct 86 (manuscript  
received 1 Apr 85) pp 2,091-2,093

[Article by M.S. Belenkiy, I.P. Lukin and V.L. Mironov]

[Abstract] It is shown that atmospheric turbulence does not give an  
appreciable contribution to an error in measurement by a heterodyne radar of  
the radial component of an object's speed. References: 5 Russian.

6415/13046  
CSO: 1860/65

UDC 551.510.535

DETERMINATION OF IONOSPHERIC PARAMETERS IN F-REGION BY RESONANCE SCATTERING  
METHOD

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian  
Vol 29, No 2, Feb 86 (manuscript received 13 Jul 84) pp 131-138

[Article by V.V. Belikov, Ye.A. Benediktov, Yu.K. Goltsova, G.M. Zhislin,  
G.P. Komrakov and A.V. Tolmacheva, Scientific-Research Institute of Radiophysics]

[Abstract] A procedure is considered for determining the temperature  $T_e$  of  
electrons, of ions  $T_i$  and the frequency of collision of ions with molecules  
 $\gamma_{im}$  in the F-region of the ionosphere by the method of resonance scattering  
of radio waves by artificial periodic irregularities of electron concentra-  
tion. Calculations are made for frequency and damping of ion sonic waves in  
plasma as a function of  $T_e/T_i$  ( $1 \leq T_e/T_i \leq 5$ ) and  $\nu_{im}$ . The magnitudes  $T_e$ ,  $T_i$   
and  $\nu_{im}$  with the given ratios  $T_e/T_i$  and the mean molecular weight of ions  $m_i$   
were determined for July 1983 at a height of 160-210 km. The method  
described makes it possible to determine a series of ionospheric parameters  
and can be used in further ionospheric investigations. The authors thank  
I.G. Zarnitsyna, T.N. Fedoseyeva, and N.D. Krupenya for conducting calculations  
on a BESM-6. Figures 3; references 19: 15 Russian, 4 Western.

6415/13046  
CSO: 1860/138

UDC 621.396.67:517,928

DIFFRACTION OF PLANE WAVE AT DIELECTRIC CYLINDER. OBLIQUE INCIDENCE

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 29, No 2, Feb 86 (manuscript received 20 Jul 84) pp 183-190

[Article by Ye.N. Vasilyev, Z.V. Sedelnikova and A.R. Seregina, Moscow Power Engineering Institute]

[Abstract] A solution of the problem of oblique incidence of an electromagnetic wave at a dielectric cylinder of finite length, with two different polarizations of the incidence field, is obtained by the method of integral equations for the equivalent surface currents. The distribution of currents and scattering diagrams are calculated for different angles of incidence. The electromagnetic field at the surface of a dielectric cylinder and scattering diagrams are considered in some detail. Figures 3; references 6: 5 Russian, 1 Western.

6415/13046  
CSO: 1860/58

UDC 538.311

FOURIER TRANSFORMATION PROPERTIES OF ANTENNA NEAR-FIELD MEASURED ON NONSPHERICAL SURFACE

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 29, No 2, Feb 86 (manuscript received 13 Jul 84) pp 191-202

[Article by Yu.I. Belov and D.Ye. Yemelyanov, Scientific Research Institute of Radiophysics]

[Abstract] The article considers the conditions for use of a Fourier transform for conversion of a field at a curved surface to the near-field of an antenna at a plane surface--the antenna aperture. The authors thank V.I. Turchin and V.S. Korotkov for discussions. Figures 4; references: 7 Russian.

6415/13046  
CSO: 1860/58

UDC 621.371.551.508

SOUNDING THE IONOSPHERE BY CONTINUOUS LINEAR FREQUENCY-MODULATED RADIO SIGNALS

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 29, No 2, Feb 86 (manuscript received 23 Jul 85) pp 235-237

[Article by V.A. Ivanov, V.A. Frolov and V. Shumayev, Mariyskiy Polytechnical Institute]

[Abstract] In the spring of 1985 development of a linear frequency-modulated continuous action ionosphere sound was completed at the Mariyskiy Polytechnical Institute. The device contains two linear FM oscillators operating in the 0.5-10 Mhz frequency range and constructed according to the principle of synthesizers of multilevel signals, a receiver with a pass band of 150 Hz, a parallel-type spectrum analyzer, a unit for display of ionograms, and a power amplifier. The authors thank L.M. Yerukhimov for attention to their work and L.V. Grishkevich for the data made available with respect to pulse sounding of the atmosphere. Figures 4; references 8: 7 Russian, 1 Western.

6415/13046  
CSO: 1860/58

UDC 621.371.246

AMPLITUDE FLUCTUATIONS OF COLLIMATED GAUSSIAN BEAM OF MILLIMETER RANGE RADIO WAVES IN ATMOSPHERIC OXYGEN ABSORPTION LINES

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 29, No 2, Feb 86 (manuscript received after revision 15 Jul 85) pp 237-240

[Article by R.I. Kurbatova, I.M. Fuks and L.I. Sharapov, Institute of Radiophysics and Electronics, UkSSR Academy of Sciences]

[Abstract] The results are presented of calculations of the fluctuations in the level of a collimated Gaussian beam of millimeter-range radio waves in the oxygen absorption lines of the atmospheric boundary layer ( $\lambda = 5$  mm and 2.53 mm). The method of conducting the calculations is described. Figures 2; references 9: 8 Russian, 1 Western.

6415/13046  
CSO: 1860/58

UDC 621.314.672

REDUCTION OF MODELS DURING OPTIMUM DESIGN OF SEMICONDUCTOR CONVERTERS

Kiev TEKHNIЧЕСКАЯ ЭЛЕКТРОДИНАМИКА in Russian No 5, Sep-Oct 86 (manuscript received 16 Oct 85) pp 19-26

[Article by Vladimir Yefimovich Tonkal, head of department, Institute of Electrodynamics, UkSSR Academy of Sciences; Aleksandr Viktorovich Novoseltsev, candidate of technical sciences, senior scientific research worker, Institute of Electrodynamics, UkSSR Academy of Sciences and Sergey Petrovich Denisyuk, junior research worker, Institute of Electrodynamics, UkSSR Academy of Sciences]

[Abstract] Methods are considered for reducing the models of semiconductor converters during computer-aided design. The distinctive features are derived for reducing the equivalent circuits and equation systems of a converter. An algorithm for optimization of the parameters and types of operation of converters is developed using the reduction of models. In this way it was possible on the average to shorten computing costs by 20-30 percent as compared with ordinary methods of multicriterion optimization. Figures 2; references 11: 10 Russian, 1 Western.

6415/13046

CSO: 1860/66

UDC 621.318.3:629.439

SELECTION OF RANGE OF FORCE GENERATING COMPONENT PARAMETERS FOR ELECTROMAGNETIC SUSPENSION SYSTEM

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 9, Sep 86 pp 33-38

[Article by Yuriy Alekseyevich Bakhvalov, Vladimir Ilich Serebryakov and Olga Ivanovna Morozova]

[Abstract] The force generating elements of an electromagnetic suspension system for high-speed ground transport are described by the following crucial engineering parameters: 1) the suspension quality (the ratio of the suspension force developed by an electromagnet to its weight; 2) the specific power (the ratio of the electromagnet power consumption to the generated force); 3) the per-unit-length mass of the ferromagnetic rail; 4) the air gap. Formulas are adduced for these four quantities and a multiple criteria analysis is made in order to optimize electromagnet parameters for such rail transport. Extensive numerical calculations on a YeS 1022 computer are reduced to the form of graphs and nomograms showing the range of electromagnet parameters for possible design variants. The optimal values are: The per-unit-mass of the ferromagnetic rails ranges from 50 to 80 kg/m; the specific power runs from 0.2 to 0.3 kW/kN; the air gap is about 15 mm; the magnetic induction is 0.7 to 0.7 and the current density is 3 to 5 A/mm<sup>2</sup>, while the width of an electromagnet pole is 25 to 40 mm. It is anticipated that with improvements in the fabrication technology and the quality of the working materials and cooling systems, the specific power can be brought down to 0.1 kW/kN and the "suspension quality" can be increased to 12. Figures 5; references: 3 Russian.

8225/13046  
CSO: 1860/55

## CALCULATING LOSSES IN SUPERCONDUCTING MAGNET OF ELECTRODYNAMIC SUSPENSION SYSTEM

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 9, Sep 86 (manuscript received after revision 5 Jun 84) pp 39-44

[Article by Aleksandr Vasilevich Kurakin]

[Abstract] Superconducting magnet systems used in high-speed ground transport in the underframe of the vehicles will be subjected to vertical oscillations at frequencies of up to 10 Hz and amplitudes of no more than 10 percent of the suspension height, thus creating additional losses in the windings, because of the resulting alternating magnetic fields. This paper determines these losses for the case of sinusoidal vertical oscillations of the underframe, when the superconducting winding is exposed to a strong DC field and the alternating field is superimposed on it. The following major steps comprise the resulting loss computation algorithm: 1) the calculation of the values of the constant and variable components of the magnetic induction at a selected point; 2) the calculation of the critical current density at the selected point, taking into account the constant field component and the parameters of the superconductor; 3) the calculation of the vertical and horizontal power loss components at this point and then their summation; 4) the calculation of the distribution of the losses over the volume of the winding and the overall loss computation. The program takes into account the critical current density as a function of the alternating field in the winding as well as the inconstancy of the transport current level in the "frozen" flux mode when calculating the amplitude of the alternating secondary field. Sample calculations are provided for a solenoid with dimensions  $2L \times 2A = 5.0 \times 2.0$  cm (with a winding cross-section of  $2H \times D = 2 \times 2$  cm), wound with composite HT-50 wire 0.5 mm in diameter. The specific hysteresis loss distribution at 2 Hz is shown graphically, though no experimental confirmation of the method is noted. The proposed procedure can be used in computing the temperature field in superconducting windings of suspension magnets for high-speed ground rail transport systems. Figures 3; references 9: 4 Russian, 5 Western (3 in Russian translation).

8225/13046  
CSO: 1860/55



UDC 621.317.38

FIELD-EFFECT TRANSISTORS AS FUNCTIONAL CONVERTERS IN ELECTRIC MEASURING DEVICES

Kiev TEKHNIЧЕСКАЯ ELEKTRODINAMIKA in Russian No 5, Sep-Oct 86 (manuscript received 13 Jan 86) pp 101-104

[Article by Vladimir Stepanovich Skryabinskiy, candidate of technical sciences, senior scientific research worker, Institute of Electrodynamics, UkSSR Academy of Sciences, Kiev]

[Abstract] Semiconductor diodes and vacuum tubes are unsatisfactory for building precise measurement converters. Problems are considered concerning the use of series-produced field-effect transistors as converters with square-law volt-ampere characteristics in measurement instrument, but the results showed that the required precision could not be obtained. Figures 5; references: 3 Russian.

6415/13046  
CSO: 1860/66

UDC 536.532(088.8)

DESIGNING INSTRUMENTATION SYSTEM WITH MEASUREMENT CIRCUIT ERROR CORRECTION BASED ON MULTIPLE CALIBRATION POINT TEMPERATURE STANDARD

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 29, No 9, Sep 86 (manuscript received 1 Oct 85) pp 12-18

[Article by A.A. Sachenko, Ternopol Financial and Economic Institute, recommended by Department of Computer Processing of Economic Information]

[Abstract] Instrument errors in temperature measurement systems can be significantly reduced by real-time calibration of the temperature transducer circuitry. This requires a temperature calibration standard. Temperature calibrators can be built that are capable of marking 10 or more precise temperature points: They consist essentially of concentric layers of pure metals surrounding the sensing element, which notes the precise phase transition temperatures as these pure metal layers melt and recrystallize. This paper details an error correction algorithm and microprocessor system for

on-line measurement channel error correction in temperature measurement systems using a multipoint calibrator built into the temperature transducer structure. Tests of a 32-channel temperature measuring system incorporated in a process control system for long products showed that the maximum instrument error in a temperature range of 100 to 600°C using this calibration and correction technique based on the phase transition points of pure metals (lead, tin and zinc) does not exceed 1°C. The paper also shows the error correction algorithm flowchart and details its operation. Figures 3; references 8: 7 Russian, 1 Western.

8225/13046  
CSO: 1860/47

UDC 532.529

#### APPARATUS FOR STUDYING RATE OF STEAM CONDENSATION IN FLUID

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 29, No 9, Sep 86 (manuscript received 4 Oct 85) pp 84-86

[Article by A.F. Zaletnev, N.N. Romanov, A.V. Fedorov and S.Yu. Shemyakin, Leningrad Refrigeration Industry Engineering Institute, recommended by Department of Theoretical Principles of Heating and Refrigeration Technology]

[Abstract] A laboratory apparatus was designed and built for determining the steam generation and condensation rate in a fluid. The apparatus is configured as a closed circulation loop containing a constant-temperature vessel; the liquid heated in the vessel is fed through a flow-rate meter into a circular quartz tube 1,000 mm long and 18 mm in diameter, containing the steam generating element. Upon reaching the top edge of the tube, the liquid flows down through the gap between the outer wall of the tube (22 mm diameter) and the inside surface of the outer pipe with a square cross-section of 36 x 36 mm, also made of quartz. The fluid then returns to the constant-temperature vessel. The apparatus can analyze steam formation conditions at the heating element at surface thermal flux densities up to the critical ( $P = 0.1$  MPa for  $q$  of less than  $2 \text{ MW/m}^2$ ) and fluid flow rates of up to 1 m/s. The error in the determination of the steam condensation heat in the fluid is  $\pm 10$  percent. Figures 1; references: 2 Russian

8225/13046  
CSO: 1860/47

COMBINED SENSOR OF ELECTROMAGNETIC FIELD IN CONDUCTING MEDIUM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 10, Oct 86 (manuscript received 26 Nov 84) pp 2,071-2,078

[Article by E.S. Kochanov and Ye.F. Zimin]

[Abstract] A new type of combined sensor is described which has an efficient construction and can measure simultaneously variable electrical and magnetic fields in a conducting medium with high sensitivity and a low mutual effect of the channels (decoupling not less than 80-100 dB). Figures 5; references 3: 2 Russian, 1 Western.

6415/13046  
CSO: 1860/ 0065

UDC 621.396.96.23

SPECTRAL CHARACTERISTICS OF ANGLE NOISE IN DIRECTION FINDER WITH FM SIGNAL

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 10, Oct 86 (manuscript received 27 Jun 85) pp 2,093-2,095

[Article by A.A. Monakov and R.V. Ostrovityanov]

[Abstract] The article determines the correlation function and the spectral density of bearing deviations during the tracking of a complex target by a direction finder with an FM signal. Figures 2; references: 3 Russian.

6415/13046  
CSO: 1860/65

UDC 62-83:66:658.012.011.56.005:681.3

PROBLEMS OF INTRODUCING COMPUTER-CONTROLLED THYRISTOR-POWERED ELECTRIC DRIVES  
IN MANUFACTURING OPERATIONS PROCESSING PLASTICS

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in  
Russian No 9, Sep 86 (manuscript received 25 Dec 85) pp 93-96

[Article by Georgiy Yakovlevich Pyatibratov, Aleksandr Aleksandrovich Denisov  
and Vladimir Ivanovich Nadtoka]

[Abstract] The plant technical management automation systems used in plastic manufacturing include a variety of electric drives for plastic processing systems. The requisite speed control range of such thyristor-controlled motors usually runs from 20:1 to 30:1 with process flow requirements dictating a speed precision of 2 to 3 percent. The best thyristor-controlled electric drives are the KTE-type direct current drives built by the Preobrazovatel Zaporozhskiy Production Association. They provide speed control of no less than 50:1 when controlling electric motors with power ratings of from 5 to 1,000 kW; they do not require forced cooling; they have a good trouble-shooting system and interchangeable modules. Their circuit design enables the use of speed or e.m.f. feedback from the motor and efficient limiting of the maximum motor current in static and dynamic operating modes. A number of recommendations is made for the design of high-power semiconductor converters for applications in microprocessor and computer-controlled drives in the chemical industry. When designing high-power thyristor control circuitry, one must concentrate on the development of highly reliable and easy to service complete system packages, with a diagnostic system that meets the specific operational requirements for chemical process control. It is expedient to conduct comprehensive studies that evaluate the impact of the electromechanical inputs on the plastic processing parameters and use them as the basis for determining the possibilities for optimizing process hardware operation through better use of controlled electric drives. References: 3 Russian.

8225/13046  
CSO: 1860/55

# INTEGRO-SUMMATION ALGORITHM FOR PARAMETRIC IDENTIFICATION OF LINEAR DYNAMIC OBJECTS

Kiev DOKLADY AKADEMII NAUK UKRAINSKOY SSR: SERIYA A: FIZIKO-MATEMATICHESKIYE I TEKHNIЧЕСКИYE NAUKI in Russian No 9, Sep 86 (manuscript received 4 Feb 86) pp 70-72

[Article by A.F. Verlan, V.I. Bilenko and E.E. Esanov; presented by UkSSR Academy of Sciences Academician V.I. Skurikhin; Institute of Problems of Simulation in Power Engineering, UkSSR Academy of Sciences]

[Abstract] A system is described by an integral dynamic model in the form of an integral Volterra equation of the second kind written in terms of the known quantities, the parameters to be identified and the input and output signals. This paper solves the model equations by using summation operators from function approximation theory in order to represent the input and output signals as generalized polynomials; this solution is then the basis for a numerical algorithm that identifies the parameters of such a dynamic model. Two theorems are presented that define the errors of this integro-summation algorithm. The second theorem determines the algorithm error in the case when interpolated cubic spline operators are used as the summation operators. No numerical examples or applications are cited. References 8: 7 Russian, 1 Western (in Russian translation).

8225/13046  
CSO: 1860/53

UDC 621.373

# SYSTEM OF AUTOMATED STUDY OF HIGH-FREQUENCY POWER SOURCES FOR ELECTRICAL TECHNOLOGIES

Kiev TEKHNIЧЕСКАЯ ELEKTRODINAMIKA in Russian No 5, Sep-Oct 86 (manuscript received 20 Jun 85) pp 86-92

[Article by Aleksandr Sergevich Vasilyev, doctor of technical sciences, head of department, Leningrad Electrical Engineering Institute; Yuriy Konstantinovich Blinov, candidate of technical sciences, senior scientific research worker, Leningrad Electrical Engineering Institute; Lev Valeryevich Sazonov, head of laboratory, All-Union Scientific Research Institute of High-Frequency Currents, Leningrad and Olga Pavlovna Yablonskaya, junior research worker, Leningrad Electrical Engineering Institute]

[Abstract] Creation of effective, reliable sources of power based on vacuum-tube oscillators operating in an electrical engineering device is impossible without mathematical simulation of the electromagnetic processes involved on a computer. This is because it is impossible to use the linear theory of vacuum-tube oscillators accepted in radio engineering for an analysis of

high-power radio transmitting devices, operating with a load which has variable parameters in which the nonlinearity of the tube characteristics plays a substantial role. In this case the only possible method of analysis of the electromagnetic processes is digital simulation. Consequently, a system of automated study of vacuum-tube oscillator circuits was developed for this goal. An account is given of its possibilities and structure. Figures 4; references 7: 4 Russian, 2 Western (1 in Russian translation).

6415/13046  
CSO: 1860/66

UDC 62-50

#### SPECIFIC FEATURES OF DIGITAL CONTROL SYSTEMS HAVING VARIABLE STRUCTURE

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 29, No 9, Sep 86 (manuscript received 23 Jul 85) pp 28-31

[Article by Ye.G. Zhanzherov, Perm]

[Abstract] In digital control systems employing time quantization of the signal, the usual conditions for zero-overshoot response derived for analog systems may not be fulfilled in variable structure systems. This paper analyzes the impact of time quantization on the requisite conditions for the existence of a zero-overshoot response and makes recommendations for maintaining an operating mode close to the zero-overshoot mode for such systems. In this general formulation, the variable structure system is described by a system of equations written in terms of the vector of state, the control input, multiplying constants for these two variables, where the constants are described by matrices, as well as in terms of the order of the system and the order of the control input. It is shown that time quantization here creates a delay when the system structure is reconfigured, where this delay is always less than the quantization period. The major feature of these variable structure control systems is that only a quasi-zero-overshoot mode can exist in them, where this response has a frequency limited to a maximum of half of the quantization frequency. In practical system designs, a variable configuration can be simplified by reducing the order of the equations describing the constant component of the system, thereby reducing the order of the function describing the system configuration change. No numerical examples or applications are cited. Figures 1; references: 4 Russian.

8225/13046  
CSO: 1860/47

## COMPARATIVE EVALUATION OF MATHEMATICAL DESCRIPTIONS OF ASTATISM CONSTRAINT IN SYSTEM

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 29, No 9, Sep 86 (manuscript received 24 Jun 85) pp 19-24

[Article by M.G. Zotov, Moscow Institute of Electronic Machine Building]

[Abstract] When deriving analytical expressions describing system behavior for systems required to have a specified order or astatism and an infinite memory, the use of the mathematical description of the astatism constraint developed for systems with a finite memory leads to degenerate cases (infinite memory systems have a transient process time approaching infinity). This paper proposes a new mathematical description of the astatism constraint for such systems, deriving general equations for the optimal transfer function of a system that possesses a specified order of astatism. The astatism constraint is written in the form of a requirement for the convergence of an integral or as a system of algebraic equations (the latter is used in the design of finite memory systems as well). No specific applications are discussed. Figures 4; references: 5 Russian.

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## RESULTS OF AUTOMATED DESIGN OF HIGH-VOLTAGE MULTIPLIERS

Moscow ELEKTRICHESTVO in Russian No 10, Oct 86 (manuscript received 25 Dec 85) pp 60-62

[Article by V.V. Vlasov, V.I. Filimonov and V.S. Baraboshkin]

[Abstract] A design of voltage multipliers is proposed, at the base of which is a method for computer analysis of electronic circuits. The method does not require preliminary simulation on a computer of the equations describing the circuit. A universal program for computer analysis of electronic circuits realized in FORTRAN language is used for solution of the design problem. It is concluded that automation of the design of voltage multipliers is an extremely effective instrument for investigation and design of high-voltage amplifiers in electrical hydrodynamic systems of automation. By means of simulation of the effect of the parameters of input pulses (different from sinusoidal) on the level and quality of output high voltage, it is possible to draw up recommendations with respect to optimization of the parameters of converter circuits, as well as recommendations with respect to efficient operation of voltage multipliers. Figures 7; references: 10 Russian.

6415/13046  
CSO: 1860/57



OPERATIONAL CHARACTERISTICS OF THYRISTOR ELECTRIC DRIVES IN AUTONOMOUS  
ELECTRIC POWER SYSTEMS OF MARINE DRILLING INSTALLATIONS AND MEANS OF THEIR  
IMPROVEMENT

Moscow ELEKTROTEKHNIKA in Russian No 10, Oct 86 (manuscript received 17 Apr 86)  
pp 17-19

[Article by T.S. Atakishev, candidate of technical sciences, A.I. Skoblikov,  
T.M. Khabigulin, I.G. Glikman, engineers, A.A. Baryudin, candidate of technical  
sciences, Azarb Institute of Petrochemistry, imeni M. Azizbekov]

[Abstract] Thyristor dc electric drives are used for the major technological mechanisms on marine drilling installations. An independent electric power plant combined with diesel-electric drive forms and electromachine ac-dc power transmission on such installations. Studies have shown that optimization of diesel generators used in such systems can greatly improve their economic characteristics. A special device has been developed to smooth the power consumption curve, avoiding extremely low-load periods on the diesel generator. The operation of the device has shown that it effectively smooths the power consumption curve, thus improving the reliability of diesel generators. The use of variable thyristor electric drives means that up to 80 percent of the electric loads are valve-type loads, which can cause distortion in the shape of the ac voltage curve. There is no standard for accuracy of sine-wave shape of the ac voltage on a marine drilling unit, and more than 10 years experience in operating such devices indicates that variations from true sine-wave state have not caused serious problems. However, as the systems are automated using microcomputers, which are quite sensitive to power quality, it may become desirable to do so. Improved power quality may also reduce power losses to higher harmonics of voltage and current. References: 3 Russian.

6508/13046

CSO: 1860/49

## TRANSLATOR FOR ELEKTRONIKA DZ-28 MICROCOMPUTER

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 9, Sep 86 (manuscript received 14 May 86) pp 105-107

[Article by Valeriya Mikhaylovich Kochetkov]

[Abstract] The Elektronika DZ-28 personal computer is usually provided with a translator from BASIC; this translator does not allow effective use of the computer in electrical engineering applications requiring complex algebra. The Leningrad Institute of Rail Transportation Engineering has developed a translator for the computer using an input language close to the standard FORTRAN-IV (though limited because of the small main memory). The new translator provides greater speed, extensive use of complex algebra, places no stringent constraints on the number of characters in the names of variables and functions, provides for better fault diagnosis and a larger main memory capacity free for programs and numbers, as well as the capability of a modular structure for subroutines that can be linked together in a single system by a built-in linkage editor. Two versions have been developed for memories of 32 and 128 Kbytes. The translator has worked well in applications to field theory, electrical engineering and electromechanical problems. Persons interested in the translator or the associated library of applied programs can write the author at : 190031, Leningrad, Moskovskiy Prospekt, Dom 9, Leningrad Institute of Rail Transport Engineering.

8225/13046

CSO: 1860/55

# PRINCIPLE OF HARDWARE CORRECTION OF SYNCHRONIZATION FAILURES AND ERRORS IN PERIPHERAL MEMORIES

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 29, No 9, Sep 86 (manuscript received 4 Sep 85) pp 42-47

[Article by A.P. Tipikin, Kursk Polytechnical Institute, recommended by Department of Computer Engineering]

[Abstract] The best hardware-based error recovery schemes for high data density stores with fast exchange rates are based on redundant codes (e.g., Reid-Solomon). The partitioning of the data flow into blocks of code words elevates the requirements placed on the synchronization system for the error protection circuitry. This paper analyzes a scheme for the simultaneous correction of synchronization loss and other errors in external memories using the same correcting code. This is done by employing the principle of adaptive combined reading and writing in the peripheral memory with the bypassing of defects in the data medium coating. It consists in the check reading of data during the writing, the comparing of the written and immediate read-out data and the repeat writing of the block of interleaved code words if the number of errors ascertained in the comparison is over a threshold value. A block diagram of the proposed system complements the relevant analytical expressions defining the error thresholds. The number of instruction cycles of a central key component of the decoder in the system (the unit for calculating the polynomials of the locators and errors) is found not to exceed 70 in the worst case and the resulting decoding time for a single code word does not exceed 20 microseconds. This scheme substantially reduces the dependence of proper error correction circuit operation on the operational stability of its synchronization system. Figures 2; references 7: 5 Russian, 2 Western (1 in Russian translation).

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CSO: 1860/47

UDC 518.5:681.3

# MICROPROCESSOR EXECUTION OF VOLDER ALGORITHMS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 29, No 9, Sep 86 (manuscript received 27 Feb 85) pp 37-41

[Article by N.S. Anishin, Kubanskiy State University, recommended by Department of Applied Mathematics]

[Abstract] Iteration algorithms are the ones best suited to computing elementary functions (especially those with two arguments). This paper derives some variants of "digit by digit" (Volder) algorithms that improve the iteration precision and speed when calculating functions of two arguments,

typically:  $(x^2 + y^2)^{1/2}$  and  $\arctan(y/x)$ . The basis for the procedure is a Medzhit algorithm, with the second step taken from a Volder algorithm, both steps then being executed in parallel. An Iskra 1256 microcomputer was used to run such an algorithm simulating the integer arithment of a 16-bit micro-processor, computing the above two functions for various values of x and y taken from the following groups, respectively: 1) 306, 526, 1,060, 1,960, 3,173, 5,189, 7,252; 2) 159, 356, 852, 1,509, 2,967, 4,090 and 6,069. The mean square errors were about 1 unit of the lowest order digit in the result (1.081 for  $\arctan(y/x)$  and 1.022 for the other function). Such digit-by-digit iteration algorithms adapted for integer execution on a computer with a limited word length can be used in microprocessor system for calculating some elementary function with a precision equal to the total processor word length. References: 3 Russian.

8225/13046  
CSO: 1860/47

UDC 681.327.6

#### QUALITY CONTROL REJECTION PROCEDURE FOR FERROACOUSTIC INFORMATION MEDIA

Leningrad IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 29, No 9, Sep 86 (manuscript received 6 Sep 85) pp 48-51

[Article by Ye.V. Antonov, D.N. Pafomov and A.V. Smirnov, Leningrad Institute of Aviation Instrument Making, recommended by the Department of Automated Control Systems]

[Abstract] Ferroacoustic memories use cold-drawn wire as the recording media in which a mechanical stress is produced by a traveling ultrasonic pulse that localizes a "1" or "0" write zone in the homogeneous medium, while the magnetic field is produced by a code sequence of write current pulses corresponding to the written data. This paper proposes a technique for the sorting and rejection of defective media based on the magnetization behavior of lengths of the metallic polycrystalline ferromagnetic material. The fault detection method is based on the recorded change in the magnetic induction levels when a train of magnetic test pulses is applied in order to determine the fluctuating noise e.m.f. due to the propagation of the traveling ultrasonic pulse through inhomogeneities in the material (nonmagnetic inclusions, microcracks, local internal stresses). The magnetization test pulse trains and test readout pulses are diagrammed and it is noted that the proposed method has been successfully used to develop prototypes of ferroacoustic wire data storage media. Figures 3; references: 7 Russian.

8225/13046  
CSO: 1860/47

UDC 538.544.6

## RESONANT SCATTERING OF INHOMOGENEOUS PLANE WAVES BY REFLECTIVE GRATINGS

Kiev DOKLADY AKADEMII NAUK UKRAINSKOY SSR: SERIYA A: FIZIKO-MATEMATICHESKIYE I TEKHNICHESKIYE NAUKI in Russian No 9, Sep 86 (manuscript received 30 Dec 85) pp 56-59

[Article by Yu.K. Sirenko; presented by UkSSR Academy of Sciences Academician V.P. Shestopalov, Institute of Radiophysics and Electronics, UkSSR Academy of Sciences, Kharkov]

[Abstract] When reflective diffraction gratings are excited by a plane, nonuniform H-polarized wave, the energy concentration in the spectrum of the secondary field is not uniform. This indicates that the diffraction emission (and scattering efficiency) can be optimized in a particular direction as a function of the grating geometry. Primary attention is devoted to the region of "resonant" change in the values of a parameter describing the relative electron velocity close to the speed of light (due to the interest in relativistic diffraction electronics). This paper discusses the behavior of the scattering efficiency as a function of relative height of comb grating segments for electron velocities between  $0.9c$  and  $0.99c$  ( $c$  = speed of light) and different scattering angles. While no analytical expressions are derived, the qualitative description of grating performance shows that an echelette naturally satisfies the requirements customary for relativistic electronics devices related to producing an intense, nearly vertical emission when electron fluxes interact with such shallow periodic structures. The observations in this paper allow the selection of the optimal parameters of reflective gratings. Such principles may serve as the basis for new, high-power relativistic emission sources at millimeter and submillimeter wavelengths. Figures 2; references: 4 Russian.

8225/13046

CSO: 1860/53

## ELECTROMAGNETIC SHOCK WAVE IN RECTANGULAR WAVEGUIDE WITHOUT DISPERSION WITH A CUBICALLY-NONLINEAR DIELECTRIC

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 10, Oct 86 (manuscript received 11 Jun 84) 1,909-1,914

[Article by M.V. Koronov, S.V. Koshevaya and M.Y. Omelyanenko]

[Abstract] The possibility is considered of forming electromagnetic shock waves in a rectangular waveguide charged with a homogeneous cubically-nonlinear dielectric, in the process of interaction of  $TE_{no}(n\omega_0)$ -waves. Resolution of nonlinear waves to plane partial waves makes it possible to decrease the wave equations and consequently to reduce the problem to one dimension, in which case a solution for plane partial waves is not at variance with the boundary conditions at the waveguide sides, which indicates the correctness of resolution. In connection with Kerr's high-frequency effect, the process considered has a nonsynchronous nature. In spite of this, a shock wave is formed in the waveguide which possesses an infinitely steep front. Figures 3; references 10: 8 Russian, 2 Western.

6415/13046

CSO: 1860/65

## Q-FACTOR OF CYLINDRICAL RESONATOR WITH COAXIAL PROJECTION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 10, Oct 86 (manuscript received 9 Apr 85) pp 1,915-1,921

[Article by V.N. Rodionova and G.Ya. Slenyan]

[Abstract] A technique is developed for calculation of the natural  $E_{0np}$  oscillations of a cylindrical resonator with a coaxial projection, with the nonideal conductivity of the resonator wall taken into account. In so doing a modified method of residues, previously used only for problems of excitation and diffraction, is generalized to include cases of the problem of natural oscillations. A variation is considered of the perturbation method with respect to surface impedance, effective in combination, e.g., with the modified method of residues for calculation of losses in resonators and waveguides of relatively complex geometrical forms. A similar technique can also be used with other types of oscillations of a specific resonator as well as for other electrodynamic systems with similar configurations, e.g., microstrip waveguides. Simple formulas are obtained for the unloaded Q-factor of the  $E_{0ip}$ -oscillations of a cylindrical resonator with a coaxial projection, which agree well with the results of measurements. A cylindrical resonator with a coaxial projection, changed by a mobile metal ring, assures a higher (by 6-7 times) Q-factor at  $E_{010}$ -oscillations than a coaxial resonator at  $TEM_1$ -oscillations changed by a contactless plunger. The authors thank Yu.V. Kobylinsk

for carrying out computer calculations. Figures 2; references 17: 16 Russian, 1 Western (in Russian translation).

6415/13046  
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SPECIAL FEATURES OF RADIAL DISTRIBUTION OF THE AMPLIFICATION INDEX OF NEON-  
HELIUM PLASMA IN TRANSVERSE SUPERHIGH FREQUENCY DISCHARGE AT A 0.63 MICROMETER  
WAVELENGTH

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 10, Oct 86 (manuscript  
received 29 Jan 85) pp 2,038-2,041

[Article by V.P. Abramov, I.P. Mazanko and Ye.A. Ulanov]

[Abstract] In contrast to direct current discharge where the radial distribution of the concentrations of electrons, their average energy, the amplification index, etc., for cylindrical discharge intervals are radially symmetrical, a transverse discharge can possess a pronounced azimuthal asymmetry. The results are presented of an investigation of the radial distribution of the energy amplification  $\alpha$  of neon-helium plasma at an 0.63 micrometer wavelength with such a transverse microwave discharge. A qualitative treatment of the special features of the radial distribution of  $\alpha$  is presented. Figures 4; references 5: 4 Russian, 1 Western.

6415/13046  
CSO: 1860/65

INDUSTRIALIZATION OF TRUNK LINE CONSTRUCTION

Moscow ELEKTROSVYAZ in Russian No 10, Oct 86 p 63

[Report by editorial staff]

[Abstract] During the February 1986 conference, the Science and Engineering Council at the USSR Ministry of Communications discussed further industrialization of cable trunk line and radio relay link construction in the 12th Five-Year-Plan period. Labor and cost reduction were pinpointed as the main objectives, design and planning were found to be lacking a comprehensive approach. Recommendations were made concerning capital investment, standardization, foundation and installation work, utilization of materials (concrete, steel), appropriate revision of existing specifications (GOST 10971-78) and technical requirements (TU 16.505.027-6), and special equipment for unattended repeater stations.

2415/13046  
CSO: 1860/67

UDC 621.396.019.4

ANALYSIS OF THE CRITICALITY OF QUASI-OPTIMUM COMPLEX DEVICES FOR PULSE AND CONTINUOUS SIGNAL RECEPTION AND PROCESSING

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 10, Oct 86 (manuscript received 9 Jul 84) pp 1,939-1,946

[Article by V.S. Artemenkov]

[Abstract] A method is considered which makes it possible to investigate the factual characteristics of the precision and noise immunity of synthesized complex optimum devices for reception and processing of pulse and continuous signals, with allowance made for the pulse nature of their operation under both transient and steady state conditions. In the process these investigations can be conducted with the use of both statistical modeling and numerical methods. Figures 5; references: 7 Russian.

6415/13046  
CSO: 1860/65



THEORETICAL-MULTIPLE APPROACH TO THE CONSTRUCTION OF MOBILE RADIO  
COMMUNICATION NETWORKS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 10, Oct 86 (manuscript  
received 3 Sep 84) pp 1,989-1,998

[Article by V.T. Nikolayev and V.N. Talyzin]

[Abstract] A theoretical-multiple approach to the construction of mobile  
radio communication networks is described which makes it possible to create a  
system of radio communication and to minimize the number of the channels used.  
The conditions for application and the areas for use of this method are  
derived. In so doing, groups of the most connected subscribers, an algorithm  
for allocation of the most connected subscribers group, and formation of the  
radio communication networks are considered in some detail. References 8:  
7 Russian, 1 Western (in Russian translation).

6415/13046

CSO: 1860/65

REVIEW OF WORLD ACHIEVEMENT IN THE FIELD OF COMMUNICATION

Moscow ELEKTROSVYAZ in Russian No 11, Nov 86 pp 1-5

[Article by E.K. Pervyshin, Minister of the Communication Equipment Industry]

[Abstract] The activities are described which took place in May-June 1986  
at the International Specialized Exhibition--Systems and means of communication  
"Communication-86." Three hundred and fifty prominent firms and organizations  
from 25 countries took place in the exhibition. The total area of the  
exhibition amounted to more than 20,000 square meters. The number of visitors  
exceeded 300,000 persons. More than 1,000 exhibits from 17 ministries and  
departments were presented in the Soviet sector. A number of the items  
involved in "Communication-86" are briefly described, such as digital systems,  
satellites, fiber-optic systems, switching equipment and computer technology.

6415/13046

CSO: 1860/60

SWITCHING TECHNOLOGY AT 'COMMUNICATION-86' EXHIBITION

Moscow ELEKTROSVYAZ in Russian No 11, Nov 86 (manuscript received 15 Jul 86)  
pp 6-9

[Article by B.S. Goldshteyn, A.Ye. Kucheryavyy and N.A. Sokolov]

[Abstract] The "Communication-86" exhibition thoroughly demonstrated the principal direction in the growth of switching technology--its digitization. The relatively wide range of switching stations presented at the exhibition made it possible to formulate in this article the basic tendencies in switching technology. The parameters and structure of stations as well as the software are described in some detail. The operating characteristics and the elements of construction are also considered. Figures 1; references 4:  
1 Russian, 3 Western.

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CSO: 1860/60

UDC 621.396.946.2

SURVEY OF FOREIGN SYSTEMS OF SATELLITE COMMUNICATION

Moscow ELEKTROSVYAZ in Russian No 11, Nov 86 pp 9-11

[Article by G.Kh. Pankov, M.I. Rosenbaum, V.G. Petukhov and N.M. Zevelev]

[Abstract] Satellite communication at the "Communication-86" exhibition was presented as part of the section "Systems and equipment for satellite and cosmic communication." Although the limited extent of the exhibits made it possible to trace only some tendencies in development of the transmission of information for various purposes through satellite communication, a number of items are described.

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MUNICIPAL TELEPHONE CABLES AT THE 'COMMUNICATIONS-86' EXHIBITION

Moscow ELEKTROSVYAZ in Russian No 11, Nov 86 pp 11-13

[Article by D.L. Sharle]

[Abstract] Few traditional cables with metal strands were presented at the "Communications-86" exhibition. Production of known cable firms from the

UK, USA, FRG, and Japan was absent. Those firms (France, Finland, Brazil, GDP, and others) which demonstrated cable communication items gave preference to optical cables. Against the background of general attention to optical cables and the high-speed of their evolution, it is obvious that the technology of electrical cables remains roughly at the level of their position of the early 1980's, and new original technological solutions are few. The following items are considered in some detail: 1) current-conducting strands; 2) insulation of strands; 3) structure of core; 4) cable shield, sheath, armor; 5) cables with tubular-paper insulation in metal sheath; 6) cables with tubular-paper insulation in alumopolyethylene sheath; 7) self-carrier cables; 8) structural lengths of cables; and 9) principles of standardizing electrical parameters.

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CSO: 1860/60

UDC 621.396.61

#### FOREIGN RADIOTRANSMISSION TECHNOLOGY

Moscow ELEKTROSVYAZ in Russian No 11, Nov 86 p 14

[Article by V.G. Lavrushenkov and V.V. Shakhgildyan]

[Abstract] Foreign and Soviet exhibits and materials concerned with radio-transmission equipment presented at the International "Communication-86" exhibition are described in some detail. They included radio broadcasting and television items as well as radio relay stations for zonal and nationwide networks.

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CSO: 1860/60

UDC 621.317.799-529:621.394.763

#### ZOND HARDWARE-PROGRAM COMPLEX FOR RECORDING OF SIGNALS AND INTERACTION PROCEDURES ON TELEGRAPH NETWORK

Moscow ELEKTROSVYAZ in Russian No 11, Nov 86 (manuscript received 29 Oct 85) pp 15-17

[Article by A.N. Dzyuba, E.N. Krichevskiy, V.I. Slyusarenko and R.I. Apalko]

[Abstract] The ZOND hardware-program complex created on the basis of the Elektronika 60M microcomputer makes it possible to record and analyze the signals and interaction procedures of telegraph stations with the required precision, to conduct statistical monitoring of the quality of operation with respect to the actual load, as well as simulation of the operation of a contiguous station or terminal point. Introduction of this complex into the

telegraph network made it possible to reduce significantly the manual work during operation of switching stations and increase the operational quality of a telegraph network. Figures 1; references 4: 2 Russian, 2 Western (in Russian translation).

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CSO: 1860/60

UDC 621.395.743

#### MEANS FOR INCREASING THE EFFICIENCY OF LONG-DISTANCE COMMUNICATIONS FOR A RURAL TELEPHONE NETWORK

Moscow ELEKTROSVYAZ in Russian No 11, Nov 86 (manuscript received 10 Mar 86)  
pp 23-26

[Article by L.M. Golshteyn]

[Abstract] It is proposed to increase the effectiveness of outgoing long-distance communications for a rural telephone network (RTN) by improving access of rural users to automatic long-distance services. Access to the highly automated long-distance network involves setting up an intermediate intrayonal network between the rural system and the automated long-distance system. The rural central station is to be connected to the long-distance channels both by a semiautomatic link through a rayon center and by direct lines to the automated long-distance system. Some RTN's already have the equipment for implementing the proposed procedures. Figures 4; references: 5 Russian.

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CSO: 1860/60

UDC 621.395.74.001.681.3

#### OPTIMIZATION OF PLANS FOR ALLOCATION OF CHANNELS ON LONG-DISTANCE COMMUNICATIONS LINES

Moscow ELEKTROSVYAZ in Russian No 11, Nov 86 (manuscript received after revision 19 Jun 85) pp 27-30

[Article by O.V. Sokolov]

[Abstract] A method proposed for planning allocation of channels on long-distance communications lines is described. The article claims that the method can be used not only for long-distance cable communication lines under construction, but also during their redesign, as well as for telephone broadband channels of radio relay lines. The results obtained are also valid for digital transmission systems. The method can be extended to a redistribution of bunched channels between the transmission systems in multiple-pair coaxial

cables or fiber-optical communication lines, with the object of optimizing the number of transmission systems. At transit points of transmission systems, it is necessary to install only amplifiers or regenerators (without transformation of the spectrum for branching of a part of the channels). Figures 1; references 9: 6 Russian, 3 Western.

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CSO: 1860/60

UDC 681.325:621.395.304

#### AUTOMATION OF DEVELOPMENT OF SOFTWARE FOR DISTRIBUTED CONTROL DEVICES

Moscow ELEKTROSVYAZ in Russian No 11, Nov 86 (manuscript received 3 Jul 85)  
pp 34-37

[Article by M.Yu. Artemyev and B.V. Kosikhin]

[Abstract] The principal problems solved in the process of developing software for switching system with programmed control (SSPC) are described. These are the creation of a formalized description (model) of the algorithms of a functioning SSPC and alteration and optimization of the software. A flexible automated system for development and maintenance of software based on a formal model of the functioning SSPC processes is necessary for a successful solution of these problems. Figures 2; references 7: 1 Russian, 6 Western (3 in Russian translation).

6415/13046  
CSO: 1860/60

UDC 621.315.2.535.8

#### METHODS OF MOISTURE PROTECTION FOR OPTICAL CABLES: SURVEY

Moscow ELEKTROSVYAZ in Russian No 11, Nov 86 (manuscript received 3 Feb 86)  
pp 38-41

[Article by V.Ye. Vasilyev]

[Abstract] One of the most important problems which arise during the design of optical cables (OC) is to assure their protection from moisture, which in the case of its entrance into a cable core can impair the characteristics of optical fibers and damage the construction elements of the OC and the connecting fitting because of corrosion, or lead to their failure in the case of freezing water. As the result of work in this field, conducted in many countries, effective methods of moisture protection of OC have been created. The following items concerned with this are considered: 1) effect of moisture on the endurance and attenuation of fiber optics; 2) local methods of moisture protection; and 3) constructional and technical methods of moisture

protection. It is emphasized that as price reduction of the technology of producing fiber optics proceeds, a widened use of combined methods of moisture protection of optical cables is expected. References: 30 Western (14 in Russian translation).

6415/13046  
CSO: 1860/60

UDC 621.373.826:621.396

EFFECT OF SHRINKAGE OF PROTECTIVE SHEATHS OF OPTICAL CABLES ON DEFORMATION OF LIGHT GUIDES AND ATTENUATION IN THEM

Moscow ELEKTROSVYAZ in Russian No 11, Nov 86 (manuscript received 9 Apr 85)  
42-45

[Article by V.V. Shitov, D.A. Belogurov, R.A. Nekhorosheva and S.B. Bobrov]

[Abstract] In some designs of optical cables (OC), fiber light guides (FG) in a polymer protective coating are provided in addition to protective tubular coatings--sheaths. During their preparation and in the process of operation, the protective tubular coatings are susceptible to shrinkage and temperature effects which give rise to deformation of the FG and additional losses in the OC. An evaluation is made of the effect of shrinkage of the construction elements of the OC on the additional losses. In addition, the advantages and disadvantages of the construction of various types of OC are considered. The theoretical and experimental study conducted made it possible to develop a method for rapid checking of the magnitude of shrinkage of the polymer protective coatings and to reduce it up to 0.5-0.7 percent, and to establish the optimum spacings and radius of the light guides, with allowance made for the change of these parameters by temperature effects. Figures 5; references: 3 Russian.

6415/13046  
CSO: 1860/60

UDC 621.315.2(03)

TYPE T MUNICIPAL TELEPHONE CABLES WITH 0.64-mm DIAMETER CONDUCTORS

Moscow ELEKTROSVYAZ in Russian No 11, Nov 86 (manuscript received 7 Jul 85)  
p 46

[Article by A.S. Brisker]

[Abstract] One of the principal trends in the development of cable technology is reduction of materials consumption, first of all consumption of metals in short supply (copper and lead). This is part of the larger problem of economizing the raw material and power resources of the country. A decrease

in the diameter of the current conductor of cables is considered as a possible way to help solve this problem. Promising work is described with respect to decreasing the diameter from 0.7 to 0.64 mm of cables with plastic insulation in order to standardize the conductors of the various municipal telephone network cables. References: 2 Russian.

6415/13046  
CSO: 1860/60

UDC 521.395.741:621.317.333

#### CONCERNING PRECISION OF SEARCH FOR POINTS OF REDUCED DIELECTRIC STRENGTH OF THE INSULATION OF COMMUNICATION CABLES

Moscow ELEKTROSVYAZ in Russian No 11, Nov 86 (manuscript received 21 Jan 85)  
pp 47-49

[Article by M.G. Oysgelt and V.S. Rombro]

[Abstract] Relationships and practical results are obtained which show the accuracy of the technical solutions selected for the high-voltage source and the zero-element of high-voltage bridges developed and realized in connection with a search for points of reduced dielectric strength of insulation (SPRDS). Based on calculations, the optimum magnitudes are determined for the storage capacity of the high-voltage source, and the sensitivity of the zero-element of high-voltage bridges which must be realized during modernization of an SPRDS device. In order to increase the precision of search for the points of defects, it is necessary to employ a comparative method of measurements which assures a reduction of the volume of work with respect to elimination of the faults considered. Figures 2; references: 2 Russian.

6415/13046  
CSO: 1860/60

UDC 621.316.9

#### PROTECTION OF CIRCUITS OF BALANCED CABLE COMMUNICATION LINES FROM LIGHTNING STROKES BY MEANS OF LIGHTNING ARRESTERS

Moscow ELEKTROSVYAZ in Russian No 11, Nov 86 (manuscript received 19 Jun 85)  
pp 50-53

[Article by A.K. Slanov and N.Zh. Kitayeva]

[Abstract] In order to localize the area of damage to the circuits of balanced communication lines by lightning discharges, it is advisable to switch on small lightning arresters installed in special-purpose sleeves. In this process the area of damage is limited by the distance between adjacent installations of lightning arresters. Too frequent switching on of the protection

elements can cause a concentrated transfer of energy from one circuit to another. Consequently, it is necessary to install an optimum number of lightning arresters with which a change of the magnitude of the protectiveness between circuits will be within the limits of error of the measuring devices. Figures 4; references: 1 Russian.

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UDC 621.316.9

#### MUTUAL INDUCTANCE BETWEEN HIGH-VOLTAGE LINES AND COMMUNICATION LINES FOR DOUBLE-LAYER GROUND STRUCTURE

Moscow ELEKTROSVYAZ in Russian No 11, Nov 86 (manuscript received 16 May 84)  
pp 56-57

[Article by E.L. Portnov]

[Abstract] In order to calculate the electromagnetic compatability of communication lines (CL) and high-voltage lines (HVL), electrodynamic processes based on a solution of Maxwell equations are employed, as well as simplified processes which are based on the solution of quasi-static problems, in particular the method of mirror transformations. These procedures are used here in a discussion of the mutual inductance between CL and HVL for a double-layer ground structure. References 11: 4 Russian, 7 Western.

6415/13046  
CSO: 1860/60

UDC 621.315.2:621.396.67

#### ELECTROMAGNETIC FIELD NEAR COAXIAL CABLES WITH NONSOLID EXTERIOR CONDUCTORS

Moscow ELEKTROSVYAZ in Russian No 11, Nov 86 (manuscript received 11 Feb 85)  
pp 54-55

[Article by I.I. Grodnev, P.R. Basabskaya and V.N. Korotkov]

[Abstract] A large part of the radio-frequency cables produced today are constructed with nonsolid exterior conductors. They are made, for example, in the form of a perforated tape coated with a polymer protective envelope. In view of the high compactness of installation of these cables in contemporary radio engineering devices, a method was formulated for calculation of the electromagnetic fields appearing near cables during dissemination in them of information signals and a computer program based on the method was written. The correctness of the proposed method was verified, using specimens of cable approximately 100 meters long with periodic elliptical apertures. The constructional dimensions of this cable are presented in a table. Figures 2; references 3: 2 Russian, 1 Western.

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## SYNTHESIS OF OPTIMUM SYSTEM OF CLOCK SYNCHRONIZATION WITH RESPECT TO PILOT-SIGNAL REPEATER

Moscow ELEKTROSVYAZ in Russian No 11, Nov 86 (manuscript received 3 Jan 85)  
pp 58-61

[Article by V.A. Sivov, Yu.G. Pisarev and V.I. Prytkov]

[Abstract] In communication systems with a repeater, the necessity arises for clock synchronization of subscriber stations with respect to the pilot-signal of a repeater. The existence of this pilot-signal makes it possible for the subscriber station to be synchronized with it up to the beginning of a communication session, without radiation of the energy of a transmitter, and to remain synchronized after the transmitter starts. From this moment the signal is cophased with the pilot-signal, and if necessary can be received by each subscriber station by means of the code of the signal. Methods for providing such synchronization are described, among which the potentially most precise is the method of a closed circuit. Various systems of clock synchronization (SCS) are known which realize this method. However, the problem of synthesizing the structure of SCS, optimum with respect to some kind of precision criteria, remains open. Figures 3; references: 6 Russian.

6415/13046  
CSO: 1860/60

SOLUTION OF ACOUSTIC DIFFRACTION PROBLEM IN AXIALLY SYMMETRIC SYSTEM OF TWO SEPARATE SPHERICAL SEGMENTS

Kiev DOKLADY AKADEMII NAUK UKRAINSKOY SSR: SERIYA A: FIZIKO-MATEMATICHESKIYE I TEKHNICHESKIYE NAUKI in Russian No 9, Sep 86 (manuscript received 31 Mar 86) pp 52-56

[Article by Yu.V. Svishchev, Yu.A. Tuchkin and V.P. Shestopalov, academician of the UkSSR Academy of Sciences, Institute of Radiophysics and Electronics, UkSSR Academy of Sciences, Kharkov]

[Abstract] While the problem of wave scattering of an axially symmetric acoustic wave in an axially symmetric system of two spherical caps has been solved, this paper extends the earlier analysis to the case of an arbitrary incident wave and the following diffracting configuration: two spherical segments with radii  $a$  and  $b$  are spaced greater than  $a + b$  apart as measured along the common axis of symmetry joining their centers of curvature; the gaps in the spheres (apertures of the segments) face each other. This paper derives general expressions for the velocity potential satisfying Helmholtz's equation, Neumann boundary conditions at the surface of the segments, Sommerfeld's radiation condition and the condition that the field energy be finite in any bounded region of space. The rigorous solution of the scalar wave diffraction problem for two such infinitely thin spherical segments yields a system that can be solved only numerically and recurrence relations are found for this that substantially speeds up the computations. No numerical examples or applications are given. Figures 1; references: 7 Russian.

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CSO: 1860/53

UDC 621.3.012.8.537.521.6

SIMULATION OF TRANSIENT PROCESS IN THE LEADER CHANNEL OF ELECTRICAL DISCHARGE

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 5, Sep-Oct 86 (manuscript received 13 Feb 86) pp 12-18

[Article by Yuriy Konstantinovich Bobrov, candidate of technical sciences, head of department, Istrinskiy Branch of All-Union Electrotechnical Institute imeni V.I. Lenin and Aleksey Vladimirovich Sorokin, senior engineer, Institute of Electrodynamics, UkSSR Academy of Sciences]

[Abstract] The problem is considered of finding the space-time distribution of potential along a channel, continuously moving in the direction of the x coordinate of a lightning leader, the physical conditions of the existence and propagation of which are fully taken into account. The channel is simulated by a linear homogeneous electrical equivalent circuit with constant line resistance, inductance, and capacitance elements. Based on an analysis of such a simulation of a leader with variable length, a method is proposed for calculating the volt-second characteristics of discharge gaps. The results of this calculation agree with experimental data for gaps with a homogeneous field. Figures 4; references 13: 8 Russian, 5 Western (1 in Russian translation).

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CSO: 1860/66

UDC 621.316.564./088.8/

## CALCULATION OF CONTACT RESISTANCE OF EXPLOSIVE SWITCHES

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: ELEKTROMEKHANIKA in  
Russian No 9, Sep 86 pp 97-101

[Article by Valeriy Leonidovich Korolkov and Aleksandr Yefimovich Nesterenko]

[Abstract] The extremely large currents (up to 1,000 kA) in high power pulsed power supplies can be switched by explosive contactors that make a contact in a few tens of microseconds. Such switches consist of an outer metal electrode in the form of a hollow cylinder with teeth on the inside surface, having a tubular inner electrode aligned coaxially and containing an explosive charge. The electrodes are separated by a dielectric sleeve. When the charge is exploded, the resulting high pressure expands the inner electrode, pressing the insulation into the slots between the teeth and bringing the electrodes into contact. The contact resistance is governed only by the material of the electrodes and their contacting surface area. Contact resistances are calculated and listed for hard and soft copper, aluminum, and brass. The calculated and measured contact resistances and switching times for prototype switches are summarized in a table. Polyethylene or teflon insulation 2.5 and 6 mm thick, with annealed copper and aluminum inner electrodes and brass outer electrodes with explosive charges of 0.5 to 5.1 g of TEN produced switching times of from 19.3 to 41.6 microseconds and contact resistances of from 0.25 to  $37.6 \cdot 10^{-6}$  ohms. The procedure proposed here enables the calculation of the contact resistance and response time of such switches with adequate precision, so as to avoid the laborious experimental work involved in their design. Tables 3; figures 1; references 8: 7 Russian, 1 Western (in Russian translation).

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## STUDY OF VOLTAGE REGULATORS WITH INTEGRAL PULSE-DURATION MODULATION

Kiev TEKHNIЧЕСКАЯ ЭЛЕКТРОДИНАМИКА in Russian No 5, Sep-Oct 86 (manuscript received 3 Mar 86) pp 36-40

[Article by Yuriy Vladimirovich Rudenko, engineer (Special Design Office, Institute of Electrodynamics, UkSSR Academy of Sciences)]

[Abstract] An analysis made of voltage regulators with integral pulse-duration modulation (PDM) showed that the order of a characteristic equation depends on the method of control of PDM. If for regulators with a proportional unit of regulation, constructed on the basis of PDM, the dynamic properties are determined by a characteristic equation of the second order, then after realization of an integral method of control in the regulators, the order of a characteristic equation increases which determines the limits of the area of stability. Figures 3; references: 7 Russian.

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UDC 621.313.14

## FORCE CHARACTERISTICS OF RADIAL MOTOR-BEARING

Kiev TEKHNIЧЕСКАЯ ЭЛЕКТРОДИНАМИКА in Russian No 5, Sep-Oct 86 (manuscript received 14 Feb 86) pp 66-69

[Article by Aleksandr Grigorevich Shnayder, engineer-designer, Vinnitskiy Electrical Engineering Plant; Miron Mikhaylevich Figman, engineer-designer, Vinnitskiy Electrical Engineering Plant; and Igor Markovich Kostovetskiy, head of Design Office, Vinnitskiy Electrical Engineering Plant]

[Abstract] The Vinnitskiy Electrical Engineering Plant created a fundamentally new mechanism, a radial motor-bearing (RMB) which unites in one unit the functions of an electrical motor and a combined gas-magnetic bearing. The power interactions in the gas-magnetic suspension of the rotor of the radial motor-bearing are experimentally and theoretically investigated. Figures 5; references: 5 Russian.

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CSO: 1860/66

## CONCERNING THE STATIC STABILITY OF A SUPERCONDUCTING TURBOGENERATOR

Moscow ELEKTRICHESTVO in Russian No 10, Oct 86 (manuscript received 11 Mar 86)  
pp 13-16

[Article by V.M. Lupkin, candidate of technical sciences, All-Union Scientific Research Institute for Electrical Machine Building]

[Abstract] The most important practical problem during operation of a synchronous machine is the static stability of its parallel operation with a feeding network. In the overwhelming majority of cases it is possible during solution of this problem to utilize an analysis of a linearized system of equations (equations in variations). However, cases are possible where such an analysis based on consideration of a linear approach does not give an answer to the problem of stable or unstable synchronous machines with small deviations from an equilibrium position. As an example, in the case where the active resistance of the exciting winding is equal to zero, an analysis of the static stability of a superconducting turbogenerator (SCTG) based on linearized equations is not strictly valid in a mathematical sense. Conclusions with respect to the static stability of an SCTG can only be drawn on the basis of an analysis of an initial nonlinear system of differential equations for small deviations from an equilibrium position. References: 7 Russian.

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## TORQUE EQUATION FOR AN ELECTROMAGNETIC BRAKE WITH FERROMAGNETIC ROTOR

Moscow ELEKTRICHESTVO in Russian No 10, Oct 86 (manuscript received 10 Mar 86)  
pp 25-31

[Article by L.A. Potapov, candidate of technical sciences, Bryansk Institute of Transport Machine Building]

[Abstract] Torque equations based on the theory of an electromagnetic field are obtained for an electromagnetic brake with a ferromagnetic rotor. Torque equations for brakes with copper-plated, low magnetic, hysteresis, and solid rotors are considered. The critical speed and maximum torque are determined for brakes with a solid rotor, and an investigation is made of the effect of various parameters on the value of the torque. It is emphasized that the proposed method of determining the torque of an electromagnetic brake is substantially the simplest, most precise, and universal of known methods. A test of the equations obtained by means of a comparison of the calculated and experimental mechanical characteristics of a brake with a solid rotor confirms its accuracy. The comparative simplicity of the equations and the possibility of conducting an investigation of the effect of the parameters on the torque of the brake makes it possible to recommend it for engineering practice. Figures 3; references: 8 Russian.

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EFFECT OF LINEAR DIMENSIONS OF A SOLENOID-TYPE IMPULSE ELECTRIC MOTOR ON ITS POWER CHARACTERISTICS

Moscow ELEKTRICHESTVO in Russian No 10, Oct 86 (manuscript received 26 Mar 86) pp 50-53

[Article by I.N. Kucheryavaya, engineer, A.D. Podoltsev, candidate of technical sciences, and V.T. Chemeris, candidate of technical sciences, Institute of Electrodynamics, UkSSR Academy of Sciences]

[Abstract] Using the methods of mathematical modeling, an investigation is made of the mass, overall dimensions within the limit of possible values of efficiency and the kinetic energy of the mobile part of a solenoid-type impulse motor (STIM) in the case of a proportional increase of its dimensions. This problem is of importance in connection with an appraisal of the prospects for using a STIM in translational power mechanisms capable of originating considerable force. Figures 4; references 8: 7 Russian, 1 Western (in Russian translation).

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STATUS AND PROSPECTS FOR DEVELOPMENT OF ELECTRICAL ENGINEERING COMPLEXES FOR OIL AND COAL INDUSTRY MECHANISMS

Moscow ELEKTROTEKHNIKA in Russian No 10, Oct 86 pp 2-3

[Article by Yu.A. Nikitin, deputy minister of the electrical industry]

[Abstract] During the Eleventh Five-Year-Plan, industrial production of over 70 new types of electrical equipment for the oil and coal industries was started. Basically new electrical complexes were developed, forming the technical basis for reequipping of the electric drives of mining mechanisms during the Twelfth and Thirteenth Five-Year-Plans. The most promising of these are: an electrical complex for the EKG-20 open-pit excavator, including the first thyristor electric drive used in excavators, vacuum breakers, cable plugs, low-inertia dc electric motors, all designed to operate at +45 to -50°C; a complex with frequency-regulated thyristor electric drive for major belt conveyors, underground winches (explosive-proof version), mine hoists and other mine mechanisms rated at 100-1,250 kW; and complexes for 11 classes of drilling installations, including some with diesel-electric thyristor dc electric drives for marine drilling installations and some with adjustable dc and ac thyristor electric drives for use on land. However, the electrical equipment manufactured for the mining industry does not meet today's requirements for complex control devices using magnetic amplifiers, asynchronous electric drives with phase rotor and relay contact control. Quality control problems remain severe for devices such as the GPEZ-2500 dc generator. Major trends of future

development include the development of automated oil drilling electric drives and the manufacture of new electrical equipment for single-scoop and rotatory excavators, dump trucks, and other mining equipment.

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#### ELECTRICAL COMPLEXES FOR MARINE DRILLING INSTALLATIONS

Moscow ELEKTROTEKHNIKA in Russian No 10, Oct 86 (manuscript received 17 Apr 86)  
pp 12-14

[Article by M.G. Yuonkov, doctor of technical sciences, B.M. Parfenov, candidate of technical sciences, and A.I. Kogan and S.A. Chekalina, engineers, All-Union Scientific Research Institute of Electric Drives]

[Abstract] Studies performed at the authors' institute have shown that diesel-electric systems with flexible controlled electric drives are more suitable for the main drilling mechanisms of marine drilling installations. It is noted that ac-dc systems have the advantages of use of a single generator plant, flexibility of distribution of power among consumers and the ability to select an effective diesel generator power rating considering the total balance of power of all devices. Scientific studies were performed to determine the influence of thyristor electric drives on an autonomous power distribution network, select parameters for synchronous generators, thyristor converters and reactors, and determine methods and means for compensation of reactive energy and voltage distortions. The result has been the design of electrical equipment for new marine drilling installations which is highly standardized. The basic system is the electrical equipment of the SPBU 6,500/100 installation, including a power plant with three synchronous generators, a power thyristor converter set (5 thyristors), the electric motors for the main drilling mechanisms (6 motors), and electric motors for the cementing pumps (4 motors). Future improvements will include reductions in mass and cost of the electrical equipment and improvement of characteristics by development of two standard 750 and 1,000 kW dc motors operating at 1,000/1,500 rpm. Figures 2; references: 4 Russian.

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## ELECTRIC DRIVE SYSTEMS FOR SUPERDEEP DRILLING INSTALLATIONS

Moscow ELEKTROTEKHNIKA in Russian No 10, Oct 86 (manuscript received 17 Apr 86)  
pp 14-16

[Article by B.M. Parfenov, candidate of technical sciences, S.B. Sakharov, S.Kh. Gumerova and N.F. Mirova, engineers, All-Union Scientific Research Institute of Electric Drives]

[Abstract] As depth increases, drilling difficulty increases as well. The main drive for heavy drilling installations such as the Uralmash-8000 EP and Uralmash-15000, designed to drill to depths of up to 15,000 m, must have high power, good static and dynamic characteristics, and good control qualities. These requirements are met by the use of dc electric drive systems with broad regulation capabilities. The authors' institute has developed a thyristor electric drive system for the Uralmash-15000, differing significantly from the existing system. The new system achieves improved reliability, efficiency, and reduced cost. Maximum standardization is used. The main mechanisms of the drilling installation in the ac-dc electric drive are rotated by dc electric motors powered by a 6,000 V high voltage line through transformers and thyristor converters. The power transformers are designed for a rectified load voltage of 660 V, soon to be increased to 800 V. Studies of the influence of power supply network distortions on thyristor electric drive operation have established that where special electric power quality improvement devices are not used, the electric power in remote areas does not meet the quality requirements of the state standards. This requires the use of filter compensating devices of at least 3 Mvar for the 15,000-meter drilling installation. An indirect compensation system has been selected for use with the Uralmash-15000, consisting of both regulated and nonregulated sections. This will assure proper operation of superdeep drilling devices. Figures 1.

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## EXPLOSION-PROTECTED AND MINE-RATED ELECTRIC EQUIPMENT AT A NEW TECHNICAL LEVEL

Moscow ELEKTROTEKHNIKA in Russian No 10, Oct 86 (manuscript received 17 Apr 86)  
pp 24-27

[Article by A.I. Parkhomenko, candidate of technical sciences, general director of Donetsk Explosion Protection Scientific-Production Association]

[Abstract] In the course of more than 40 scientific studies, the authors' association has developed and begun manufacture of electrical equipment for underground mining of coal, production, transportation and refining of oil and gas, for chemical industry enterprises, for ferrous and nonferrous

metallurgical enterprises, and for open-pit mines in the Far North. Examples include the KVT-1R-10-400 10 kV, 400A vacuum mine-rated connector, used in the manufacture of the UKV-6 automatic control device; the RVV-6/10-400 high voltage reverser for the control of powerful mine hoist motors; the KT12R 1140 V 320 A contactor, used in the PVV-320 starter; the TSV series mine transformers and TSVP transformer substations; the PSKTV transformer substations rated for use in the Far North; the KTU2000 U and KTU4000 U 660/1,140 V high reliability contacts; the KUUV standardized electric drive control stations; the 2 VR improved low voltage electric motors, the VAO series 55-315 kw and 200-2,000 kw modernized motors with improved power characteristics and reliability; and the new EKVZh mining machine electric motors rated at 250 and 315 kw with a new cooling system utilizing a dielectric heat conducting fluid in the cavity between stator and rotor. Figures 3; references: 7 Russian.

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#### HIGH VOLTAGE ELECTRICAL SYSTEM FOR UNDERGROUND MINING MACHINES

Moscow ELEKTROTEKHNIKA in Russian No 10, Oct 86 (manuscript received 17 Apr 86)  
pp 36-37

[Article by A.I. Parkhomenko, candidate of technical sciences, All-Union Scientific Research Institute of Explosion-Protected and Mining Electrical Equipment]

[Abstract] Some 17 types of new electrical equipment products for operation at 1,140 V have been developed with safety guaranteed to be equal to that of equipment used in 660 V mine networks. The equipment includes: a 630 kV·A transformer substation with leakage current protection, an automatic 320 A breaker, magnetic starters for currents of 25, 63, and 25 A, mining machine motors rated at 125, 160, and 200 kW, conveyor motors rated at 45, 55, 75, 90, and 110 kW, supplementary motors rated at 13, 17, and 30 kW, type EVT armored cables with connector cross sections 35-120 mm<sup>2</sup>, type GRShE flexible cables with connector cross sections 16-70 mm<sup>2</sup>, cable connectors for 160, 250, and 320 A, starter units and other equipment. Introduction of the new 1,140 V equipment will assure effective electric power supply and high quality mine power network voltage for mining machines rated up to 400 kW, increasing the capacity per mine face up to 4 million tons per day, increasing the productivity of labor by 30 percent, decreasing the cost of coal by 9-10 percent, and achieving an economic effect of 400,000 rubles per year per coal mining complex. Photographs show the TSVP-1000/6 transformer substations, the EKVSh4-315 mining machine electric motor and the KUUV-350 control unit.

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## LARGE AC ELECTRICAL MACHINES FOR MINING, BENEFICIATION AND EXTRACTION OF USEFUL MINERALS

Moscow ELEKTROTEKHNIKA in Russian No 10, Oct 86 (manuscript received 17 Apr 86)  
pp 40-43

[Article by G.S. Vasilev, candidate economic sciences and A.B. Klaren, engineer, Central Design and Technological Bureau for Large Electrical Machine Building]

[Abstract] During the Eleventh Five-Year-Plan, production of new highly effective series of asynchronous motors was undertaken, including the A4, DAZ04-400, 450, and the ATD4. These motors are distinguished by good power characteristics, monolithic insulation, and long service life. A number of new electrical machines have been created for drilling installations, including the SDBO and SMBO synchronous motors rated at 500 and 600 kW with brushless excitation and the AKSB asynchronous 630-1,000 kW motors rated for use in cold climates at down to  $-60^{\circ}\text{C}$  air temperature. A number of new large electrical machines have been developed for petroleum and gas production, including motors for gas pumping units such as the STD12500 shaded-pole motor rated at 12,500 kW. The ARD 250 kW, 6,000 V motors have speed adjustable between 480 and 750 rpm, and are designed to drive the pumps of beneficiation plants. The transition to 10 kV motors continues, reducing conductor cross section requirements and power network costs. All high voltage motors for the Tobolsk Petrochemical Combine are rated at 10 kV. The range of such motors will be greatly expanded during the Twelfth Five-Year-Plan. Figures 3.

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## CHARACTERISTICS OF ASYNCHRONOUS EXPLOSION-PROTECTED MOTORS OF VAO2 SERIES, RATED AT 200-2,000 kW

Moscow ELEKTROTEKHNIKA in Russian No 10, Oct 86 (manuscript received 17 Apr 86)  
pp 43-46

[Article by L.A. Zbarskiy, I.G. Shirnin, V.F. Foryagin, candidates of technical sciences, and M.I. Figotina and Yu.V. Porshnev, engineers, All-Union Scientific Research Institute of Explosion-Protected and Mining Electrical Equipment]

[Abstract] The VAO2 motors, rated at 200-2,000 kW at 6 and 10 kV, have been developed to replace the VAO series. The following steps were taken to improve the technical level of the new series: improvement of the structure, with three outside diameters of stator cores and three heights of the rotating axis instead of four outside diameters and six axis heights in the

old series; improvement of the internal cooling system, with a radial-matched cooling system with axial fan installed beneath the head of the stator winding, separated by inner and outer barriers, decreasing mechanical losses to ventilation by 20-50 percent and total mass by 20-50 percent; use of cold-contact electrical steel with specific losses 1.6-1.3 W/kg to replace hot-rolled steel, decreasing losses in the stator and rotor cores by 15-30 percent; use of installation of stator windings with monolit-2 monolithic insulation 3.8-4.2 mm thick at 6 kV instead of the 4.7-5 mm thick mica used previously, increasing slot filling factor in the copper winding by 12-42 percent; use of magnetic wedges for the stator winding, decreasing losses in stator and rotor core steel by 30-40 percent. Results of testing of the new series of motors are presented. Figures 2; references: 2 Russian.

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UDC [621.313.333:658.515].001.4

#### STANDARD FOR EXPLOSION-SAFE COAL MINING MACHINE ELECTRIC MOTORS

Moscow ELEKTROTEKHNIKA in Russian No 10, Oct 86 pp 49-50

[Article by L.B. Landkof, candidate of technical sciences, and K.D. Makarov and A.K. Bondarenko, engineers, All-Union Scientific Research Institute of Explosion-Protected and Mining Electrical Equipment]

[Abstract] Effective 1 January 1987, standard GOST 16565-71 is replaced by standard OST 16 0.510.0611-84, "Electrical rotating machines from sizes 63 to 355 inclusive. Asynchronous explosion-protected motors for driving domestic mining machines. General technical conditions," reflecting the achievements of electrical machine building and coal mining machine building in the area of improvement of the motors of mining machines. Reasons for the development of the standard are noted. The motors covered by the standard are intended to drive domestic mining machines in mines where there is a danger due to the presence of methane and coal or shale dust. The improved reliability of modern mining machines has allowed a decrease in the number of motor starts per hour from 120 to 30. The major criterion reflecting the technical level of a mining machine motor is the maximum power with minimum motor body height. The new standard can reduce the time required to develop technical conditions for specific motor types, significantly increasing their technical level, reliability, and degree of utilization. Use of the standard will expand the area of application of motors and reduce the demand for special models and modifications, improving the conditions for export of motors, as well as mining machines and planes.

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## CLOSE TO OPTIMUM PLANS FOR CONTROL FOR PREVENTING EMERGENCY CONDITIONS IN ISOLATED POWER SYSTEMS

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 10, Oct 86 pp 39-41

[Article by B.G. Menshov, doctor of technical sciences, professor; N.A. Tsvetkov and A.V. Yegorov, engineers, Moscow Institute of Petroleum and Gas imeni I.M. Gubkin]

[Abstract] At present, in areas distant from the central regions of the country, power systems exist in which a power deficiency frequently appears. A characteristic feature of emergency conditions in such power systems is the rapidity of their growth. A method is presented for preventing the appearance of an emergency situation in a system, the dimensions and complexity of which are such that it is impossible to solve the problem analytically. A procedure is obtained, economically close to optimum, for control by prevention of emergency situations. It is in the form of a packet of applied programs for the SM4 electronic computer with the RAFOS operating system. Figures 3; references: 3 Russian.

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## TOWARDS CONTROL OF ELECTRICITY CONSUMPTION UNDER CONDITIONS OF POWER RESOURCE SHORTAGE

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 10, Oct 86 pp 12-15

[Article by A.V. Prakhovnik, doctor of technical sciences, professor; V.P. Kalinchik and P.Ya. Ekel, candidates of technical sciences, Kiev Polytechnical Institute imeni 50th Year of Great October Socialist Revolution]

[Abstract] An approach to control of electricity consumption is proposed which minimizes the disadvantage from control of the load by consumer-regulators (CR) and makes it possible to take into account discrete stages of electricity consumption of the CR and the magnitude of the disadvantages corresponding to them. At the present time, control involves a priori priority schemes so that disadvantages due to user cut-offs cannot be evaluated. A formalization of the problem is presented involving stages of energy use, losses and cut-off stages and is treated as a linear programming problem. However, for more than five users, there are computation problems and a procedure involving approximation by means of discrete programming models giving quasi-optimal solutions is used. An algorithm is given for the problem. References 6: 5 Russian, 1 Western (in Russian translation).

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COMPARISON OF METHODS FOR CONTROL OF POWER CONSUMPTION

Minsk INZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 10,  
Oct 86 pp 18-23

[Article by V.S. Kakhanovich, candidate of technical sciences, assistant professor, Belorussian Polytechnical Institute]

[Abstract] Use of the method of separate consumer-regulators in control of the power consumption of industrial enterprises has become an important factor in the alignment of load schedules of electricity power systems, and consequently increases their technical and economic indices. The following methods now involved in the control of power consumption are described: 1) method of instantaneous norm; 2) method of ideal norm; 3) control with forecast; 4) control by the method of "moving window"; and methods combining the above, i.e., 5) mathematical model of process of control of power consumption; and 6) approximation of load schedule. The control process was modeled on a microcomputer and the results are given. Of the basic procedures the "moving window" was superior, and it was also found that a combined method proposed by the author involving an ideal norm with forecasting and then the "moving window" procedure gave the best results. Figures 3; references: 9 Russian.

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POWER CONSUMPTION OF PROCESSES OF RADIATION MODIFICATION OF POLYMER INSULATION

Moscow ELEKTROTEKHNIKA in Russian No 10, Oct 86 (manuscript received 12 May 85)  
pp 56-57

[Article by G.I. Meshchanov, Ye.I. Mironov, candidates of technical sciences, and E.E. Finkel, doctor of technical sciences, All-Union Scientific Research Institute of the Cable Industry]

[Abstract] Radiation modification of cable insulation allows economical utilization of the energy of ionizing radiation to obtain a technological effect. Radiation cross-linking of polymer insulation has significant advantages over thermochemical cross-linking. Little further improvement can be expected in the efficiency of commercial accelerators. Therefore, further improvements in efficiency can be achieved by such means as the use of sensitized polymer materials requiring lower doses of radiation. Decreasing the dose required by a factor of 1.5-2 can save 30-50 percent of the energy required for modification of the polymer insulation. Multipass volder systems are also more economical, allowing overlapping of cable to make more efficient use of the radiation than single-level or even closely packed schemes. Figures 3; references: 2 Russian.

6508/13046  
CSO: 1860/49

UDC 621.318.12:621.317.4

CALIBRATION OF INCOMPLETELY CLOSED MAGNETIC MEASURING SYSTEM DURING A TEST OF RARE-EARTH METALS-COBALT PERMANENT MAGNETS

Kiev TEKHNIЧЕСКАЯ ЭЛЕКТРОДИНАМИКА in Russian No 5, Sep-Oct 86 (manuscript received 25 Dec 85) pp 93-97

[Article by Yevgeniy Aleksandrovich Andriyevskiy, candidate of technical sciences, head of laboratory, Institute of Electrodynamics, UkSSR Academy of Sciences, Kiev]

[Abstract] A method is presented for calibration of the measuring channels of magnetic measuring systems with an incompletely closed magnetic circuit, in the case of a test of rare-earth metals-cobalt permanent magnets. It is shown that the proposed method makes it possible to take into account over wide limits a change of the geometrical dimensions of the magnets measured. Andriyevskiy is the author or coauthor of three published papers on which the present article is largely based. Figures 4; references: 3 Russian.

6415/13046  
CSO: 1860/66

UDC 621.319.4.025:621.314.632

POWER LOSSES IN RESERVOIR CAPACITORS FOR SHAPERS OF PULSED MAGNETIC FIELDS

Moscow ELEKTRICHESTVO in Russian No 10, Oct 86 (manuscript received 18 Feb 86) pp 68-71

[Article by B.A. Baginskiy and V.N. Makarevich, Tomsk Polytechnical Institute]

[Abstract] Analytical expressions useful for calculation of the power losses in reservoir capacitors (RC) for shapers of pulsed magnetic fields are obtained, a comparative analysis is made of the effect of the performance of RC on the change of power losses, and recommendations are drawn up with respect to the most typical regimes. Figures 3; references: 4 Russian.

6415/13046  
CSO: 1860/57



UDC 621.383.4:537.312.5

COHERENT DETECTION OF LASER RADIATION WITH FLUCTUATING PHASE

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 9, Sep 86  
(manuscript received 18 Nov 85) pp 1-3

[Article by Yu.Ya. Kozlovskiy, L.N. Neustroyev and V.V. Osipov]

[Abstract] Fluctuations in the phase of coherent radiation following transmission through the atmosphere or reflection from rough surfaces cause variations in phase between signal and reference radiation, decreasing the sensitivity of a coherent detector. This article analyses the resultant decrease in sensitivity for both heterodyne and homodyne detection of optical radiation. The results obtained show that the time of transient processes in a photoresistor is always determined by the lifetime of photocarriers. References 5: 4 Russian, 1 Western.

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CSO: 1860/48

UDC 666.189.2.535.8

PARAMETERS OF SWITCHING DEVICES IN FIBER OPTICAL COMMUNICATIONS LINES BASED ON GRADANS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 9, Sep 86  
(manuscript received 31 Oct 85) pp 3-6

[Article by V.G. Ilin, G.O. Karapetyan, N.V. Remizov and R.G. Khorenyan]

[Abstract] Gradans are increasingly used in optical instrument building. Their small dimensions and reproducible parameters allow production of fiber optic lines with low light energy losses. They are primarily used for collimation and focusing of radiation. This article presents studies of the optical properties of domestic gradans used in fiber optic lines manufactured by ion exchange diffusion. Focal spot diameters, beam divergence, relative light energy losses, and longitudinal and transverse spherical aberrations were measured. The results demonstrate the influence of aberrations on the losses in fiber optic switching devices based on these elements. Figures 4; references 7: 2 Russian, 5 Western.

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CSO: 1860/48

## OPTIMIZATION OF RECEPTION OF PULSED SIGNALS IN SYSTEMS WITH AVALANCHE PHOTO DIODES

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 9, Sep 86  
(manuscript received 18 Dec 85) pp 6-7

[Article by M.V. Voznitskiy and F.I. Khaytun]

[Abstract] A previous study investigated the effectiveness of the use of avalanche photo diodes for reception of pulsed signals, assuming negligible spectral density of amplifier noise in comparison to spectral density of photo diode noise. However, these conditions are fulfilled only with certain limitations on the noise and inertial parameters of the light receiving device and time characteristics of the signal received. This article studies the problem in more general form, including an estimate of the limits of applicability of the equations derived in the previous study. The results allow estimation of the boundary value of length of the signal received, above which the variation in  $\beta_{M \text{ opt}} (\beta)$  must be considered, as well as the potential detection characteristics of the receiving device with the avalanche diode over a broad range of noise parameters of the diode and amplifier and working signal length. Figures 3; references: 3 Russian.

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CSO: 1860/48

## ERROR OF EXPERIMENTAL ESTIMATES OF PULSE AND TRANSFER CHARACTERISTICS OF OPTICAL-ELECTRONIC INSTRUMENTS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 9, Sep 86  
(manuscript received 29 Jul 85) pp 10-12

[Article by A.P. Zakharnev]

[Abstract] Previous studies have analyzed the error in measurement of transfer characteristics. This article describes the use of error analysis theory in the study of linear systems containing an internal source of correlated noise. It is assumed that the error in formation of the effect, measurement, and recording apparatus is negligible in comparison to noise. The error analysis described was used in experimental determination of the transfer characteristics of photometers containing an internal source of correlated noise. The values of error obtained allow objective judgment to be made concerning the quality of measurements and accuracy of experimental estimates of pulse and transfer characteristics of optical-electronic systems if the samples are sufficiently representative. References 5: 2 Russian, 3 Western.

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## TWO-CHANNEL OPTICAL-ELECTRONIC TELEPHOTOMETER

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 9, Sep 86  
(manuscript received 12 Mar 85) pp 18-20

[Article by I.S. Krylov, N.N. Mareyeva, A.A. Dubenskova and V.S. Gusin]

[Abstract] The telephotometer described in this article is an optical-electronic device allowing very accurate measurement of a number of optical parameters and characteristics determining the visibility of actual objects, including measurement of the contrast of distant objects, measurement of brightness coefficients, measurement of transmission and brightness coefficients of the atmosphere, measurement of frequency-contrast characteristics of various media, and measurement of the brightness fields of distant objects. Intended for use under both laboratory and field conditions, the device consists of three main functional units: an optical-mechanical unit, signal converter and amplifier unit, and a digital information processing unit. It operates in two modes: simultaneous measurement of brightness and brightness differences and scanning measurement of the brightness of a brightness field. The characteristics of the device are analyzed. A diagram of the optical-mechanical section of the telephotometer is presented, plus a block diagram of the digital signal processing unit. Figures 2; references: 3 Russian.

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CSO: 1860/48

## MANUFACTURE OF MULTISECTION CONCAVE DIFFRACTION GRATINGS FOR THE VACUUM ULTRAVIOLET

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 9, Sep 86  
(manuscript received 29 Jul 85) pp 23-25

[Article by S.A. Strezhnev, T.S. Saamova, V.V. Kuindzhi and A.F. Baranov]

[Abstract] A study is made of the manufacture of multisection concave diffraction gratings with untreated central zone, intended for use in large aperture vacuum monochromators. No lines are scribed in the central portion of the gratings, which is achieved by a stop to limit the cutting depth of the diamond scribe so that it does not reach the surface in the center of the concave blank. To avoid changes in microgeometry of the lines due to application of the reflective coating, the coatings were applied only to the reflecting faces of the lines. This method was used to produce three-section gratings with 1,200 lines per millimeter, area  $45 \times 45 \text{ mm}^2$ , width of each section 15 mm, radius of curvature of the surface 250 mm, diameter of aperture in center 14 mm, as well as four-section gratings with 300 lines per mm  $110 \times$

110 mm<sup>2</sup> in size, width of each section 27.5 mm, radius of curvature 330 mm. Figures 3; references 14: 10 Russian, 4 Western.

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CSO: 1860/48

UDC 771.351.022

#### SPECIFICS OF OPERATION OF PASSIVE TRIANGULATION-TYPE AUTOMATIC FOCUSING SYSTEMS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 9, Sep 86  
(manuscript received 22 Jan 86) pp 34-37

[Article by A.I. Terpilovskiy, V.I. Sergeyev and A.M. Tsaruk]

[Abstract] An analysis is presented of the operation of the optical-electronic Visitronic auto focusing system. Experimental studies performed by the authors demonstrated that the focusing error of the system increases with decreasing contrast of the object being photographed. The reason for this is demonstrated. Focusing on any structure which has no changes in contrast in the horizontal direction does not work at all. Grid-type objects cause no response of the system if the dimension of one element of the image is less than the minimum area of the contrast-detecting photoreceiver. These shortcomings can be eliminated by using a matrix of photodetectors of irregular geometric shape rather than the two lines of photodetectors used in the Visitronic system. Each receptor should have the same configuration in the horizontal and vertical planes so that a change in the area covered by neighboring photoreceptors differs in any area of the surface of the matrix as the image of an object of any shape moves over it either horizontally or vertically. Figures 4; references: 1 Russian.

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UDC 621.378.8:531.717.85

#### STABILITY OF POSITION OF BEAMS OF RADIATION OF LGN-207A AND LGN-208A LASERS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 9, Sep 86  
(manuscript received 22 Oct 85) pp 56-57

[Article by N.I. Kulikova, V.A. Perebyakin and I.Sh. Etsin]

[Abstract] The LGN-207A and LGN-208A are new generation helium-neon lasers with very high stability of the radiation pattern axis due to highly symmetrical coaxial design and elimination of elastic stresses in adjustment units of the radiator, achieved by using the method of plastic deformation during adjustment. At the same time, the accuracy of fixation of the position

of the radiation beam relative to the point of installation of the laser is quite high. The basic parameters of the lasers, which are the same except for power and polarization, are presented in tabular form. The LGN-207A generates 1.5 mW, the LGN-208A generates 2.0 mW. Measurement showed that random displacements of the spot at the output of either laser were not over 0.3  $\mu\text{m}$  in 30 minutes, 0.5  $\mu\text{m}$  in 2 hours. A smooth displacement of the laser spot was observed during the first hours after the lasers were turned on, decreasing after 2 to 4 hours of operation. Random changes in radiation direction did not exceed 5" in 7 hours, the best specimens achieving 1"/7 hours. Figures 1; references: 1 Russian.

6508/13046  
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UDC 551.511.6:535.231.6

#### EFFECT OF TURBULENT ATMOSPHERE ON TRANSMISSION OF TARGET IMAGE

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 9, Sep 86  
(manuscript received 26 Nov 85) pp 57-58

[Article by N.A. Rumyantseva and M.V. Tantashev]

[Abstract] A simplification is suggested for the method of calculating the optical transfer function, used in evaluating the capabilities of optical observation systems by test observation of an optical target from a distance. The simplification is based on the assumption that the variation as a function of spatial frequency of the target pattern is a Gaussian function. The absolute error resulting from this simplification should not exceed 4 percent throughout the entire area of observation. An analytic equation is suggested which contains only the tabular function of the probability integral and is quite convenient for practical use. Figures 1; references 5: 4 Russian, 1 Western.

6508/13046  
CSO: 1860/48

## COMPARISON OF SOME METHODS OF DETERMINING COORDINATES OF IMAGES PRODUCED BY MULTIPLE ELEMENT DETECTORS FOR TRACKING EMISSION SOURCES

Leningrad IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 29, No 9, Sep 86 (manuscript received 14 Oct 85) pp 62-69

[Article by V.A. Solomatín and Yu.G. Yakushenkov, Moscow Institute of Geodesy, Aerial Photography and Cartography Engineers, recommended by the Department of Optoelectronic Instruments]

[Abstract] An equally spaced array of sensing elements produces an image of some emission source. The image overlaps several elements. This paper presents some interpolation algorithms for the measurement of the image coordinates. The major error in any position determination is due to noise in the multielement array and the signal processing circuitry, the scatter in the parameters (primarily the sensitivity) of the individual elements and procedural errors due to the particular algorithm employed. The best approach is phase interpolation, the essence of which is the realization of a raster analog, consisting of alternating strips of equal width, using a multielement detector in the form of a linear string of sensing elements. These elements are switched sequentially by a corresponding linear array of switches; this switch string in turn drives the output amplifier. The possible measurement errors are analyzed and the resulting analytical expressions are checked experimentally. An MF-14 matrix was used as the basis for a breadboarded displacement transducer. Transverse size of the light mark was 1 to 3 mm, thus overlapping no less than 4 elements of the sensing array. The fluctuation error, background modulation, and digitization errors can be disregarded in this case, and the calculated overall error was  $1.2 \cdot 10^{-2}$  mm. The measured mean square systematic error, characterizing the deviation of the displacement to phase conversion characteristic from a straight line, was  $1.5 \cdot 10^{-2}$  mm. The agreement demonstrates that the given relations can be used to calculate the conversion error and with the state of the art in multiple element sensing array technology, the position of an image in the plane of the sensitive surface of such arrays within a precision of hundredths of the size of an individual element. This is attainable only with an adequate signal to noise ratio, with images no less than three to four times greater than the sensing element size and with small gaps between the elements plus uniform sensitivity of the elements. Figures 1; references 3: 2 Russian, 1 Western.

8225/13046

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## SELECTION OF DECISION THRESHOLD IN DUAL CHANNEL OPTOELECTRONIC DETECTORS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 29, No 9, Sep 86 (manuscript received 21 Jun 85) pp 72-76

[Article by D.S. Kozarev, G.I. Leshev and V.K. Nyagolov, Leningrad Institute of Precision Mechanics and Optics, recommended by Department of Optoelectronic Instruments]

[Abstract] The effectiveness of optoelectronic instruments for detecting heat emitting sources against a radiating background can be substantially improved by using systems operating in two spectral bands, especially if the background emissions are correlated. The problem of increasing the interference immunity can be formulated as the minimizing of the sum of the interference-induced false alarm probability and signal loss probability. This minimization is accomplished in dual channel detectors by introducing a decision-making limit that segregates the interference (background) space from the emission source (useful signal) space. The choice of this decision threshold and the decision-making procedure is extremely important for such detection systems analyzing the position of random points in an attribute space and automatically assign them to one of two classes (background or signal). This paper analyzes the selection procedure employed by a minicomputer incorporated in the decision and signal processing unit of such detection systems. The technique is based on the Neyman-Pearson criterion and assumes normal distributions of the primary criteria. No sample calculations are given for the expressions found for the detection and false alarm probabilities and no hardware applications are cited. Figures 3; references: 2 Russian.

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CSO: 1860/47

UDC 537.876.4:621.383.8

## INVESTIGATION OF RADIAL PROPAGATION OF ELECTRICAL PULSES IN BIPLANAR ELECTRON-OPTICAL CONVERTERS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 10, Oct 86 (manuscript received 19 Mar 85) pp 2,079-2,087

[Article by V.P. Degtyareva, I.A. Dubovoy and V.K. Chevokin]

[Abstract] An investigation is made of the influence of induction and capacitance effects on the propagation of electrical pulses in photocathodes and microchannel plates (MCP). The nature of the process of determining potential depends strongly on the conductivity of the material of photocathodes and MCP. The time for determining the potential in a semiconductor amounts to several tens of picoseconds. This time determines the physical range of the exposure time of biplanar MCP's for operation in frame photography

of rapid processes. The authors thank A.M. Prokhorov for support of their work with respect to the diagnostics of rapidly proceeding processes, and M.Ya. Shchelev for interest in the particular work. Figures 4; references 12: 5 Russian, 9 Western.

6415/13046  
CSO: 1860/65

UDC 621.372.822.01

#### CUTOFF CONDITIONS FOR HYBRID WAVES IN RECTANGULAR AND PLANE METAL-OPTICAL WAVEGUIDES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 10, Oct 86 (manuscript received 9 Aug 85) pp 2,088-2,089

[Article by V.A. Pruzhanovskiy]

[Abstract] In practice as a rule construction of a metal-optical waveguide must be multimode (for a decrease of attenuation). However, when evaluating the bandwidth of individual modes, the necessity arises for determining the wavelength limit of this band, i.e., determination of the wavelength of the cutoff. In the present article the cutoff conditions are derived for hybrid waves in a rectangular metal-optical waveguide with a form of construction which has gold-plated polished walls for transmission of kilowatt fluxes of infrared laser radiation. References 12: 6 Russian, 5 non-Russian, 1 Western (in Russian translation).

6415/13046  
CSO: 1860/65

#### AMPLIFICATION OF COUNTERPROPAGATING WAVES OF DIFFERENT FREQUENCIES IN A DOUBLE-PASS AMPLIFIER

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 29, No 2, Feb 86 (manuscript received 12 Nov 84) pp 145-154

[Article by A.A. Betin, N.D. Milovskiy, T.N. Roshina and T.V. Yastrebova, Institute of Applied Physics, USSR Academy of Sciences]

[Abstract] The article investigates local and integral increments of the development of a weak counterpropagating field in a double-pass amplifier with a shifting frequency reverse wave front (RWF) mirror. The frequency of the shift for which the local increment has the highest value is found. The maximum amplifier gain in double-pass garnet or ruby amplifiers can be obtained by the use of RWF mirrors which shift the frequency of the reflected field by  $10^{-2}$  -  $10^{-1}$  of the line width (i.e., by  $10^{-5}$  -  $10^{-4}$  of the frequency of the fundamental field). In this case the limiting value of the amplifier



gain increases by 2-3 times as compared with a RWF mirror without a frequency shift. In double-pass systems such as CO<sub>2</sub>-amplifiers, it is advisable to use an RWF mirror reflecting the field without the shift in the carrier frequency. Figures 7; references 14: 13 Russian, 1 Western (in Russian translation).

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CSO: 1860/58

UDC 535.853.4

#### SENSITIVITY INCREASE OF A SCANNING SUBMILLIMETER RAD SPECTROMETER BY A QUASI-OPTICAL RESONATOR

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 19, No 2, Feb 86 (manuscript received 25 Apr 85) pp 240-243

[Article by V.P. Kazakov, V.V. Parshin and Yu.D. Dryagin, Institute of Applied Physics, USSR Academy of Sciences]

[Abstract] The pressing problem of increasing the sensitivity of a sub-millimeter spectrometer arises in the case of an investigation of mildly intensive molecular lines (with an absorption factor  $\alpha_{\max} < 10^{-6} - 10^{-8} \text{ cm}^{-1}$ ) as well as during absorption spectral analysis of very clean substances. The possibility is investigated of increasing the sensitivity of a sub-millimeter RAD (microwave) spectrometer by means of a quasi-optical resonator. For an RAD spectrometer any increase of the power, by absorbed gas in the unit and a more effective conversion into an acoustic signal will increase the sensitivity. Experimental investigations made with the device are described. The authors thank A.F. Krupnov for formulation of the problem and for helpful discussions of the results of the work. Figures 3; references 7: 4 Russian, 3 Western.

6415/13046  
CSO: 1860/58

UDC 535.51;621.372/822

#### PROPAGATION OF NONMONOCHROMATIC RADIATION IN ANISOTROPIC SINGLE-MODE FIBER LIGHT GUIDES

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 29, No 2, Feb 86 (manuscript received 27 May 85) pp 243-245

[Article by A.N. Zalogin, S.M. Kozel and V.N. Listvin, Moscow Physicotechnical Institute]

[Abstract] The depolarization effect which originates during propagation of nonmonochromatic radiation in anisotropic single-mode light guides (SLG) is investigated, and a proposed approach is illustrated which uses calculation of the maximum degrees of depolarization of radiation in an SLG with random non-uniformities as an example. References 6: 1 Russian, 5 Western.

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